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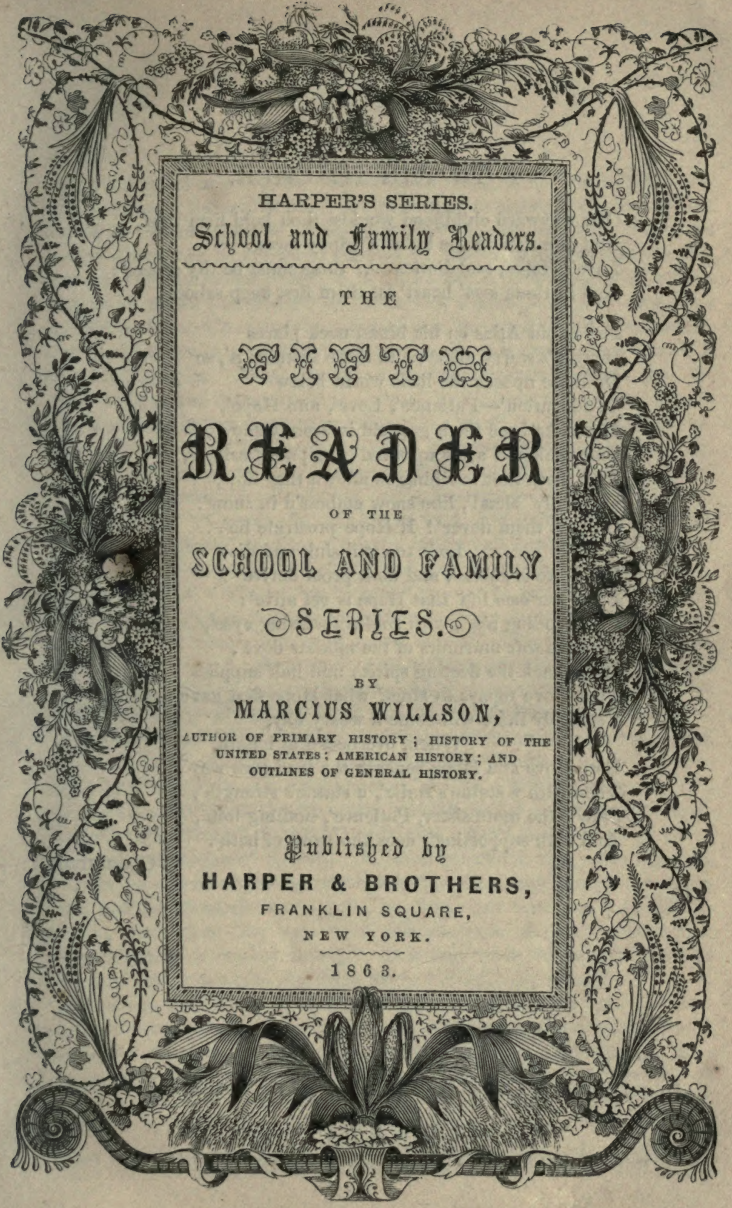
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HARPER'S SERIES.
School and Family Readers.

THE
FIFTH
READER
OF THE
SCHOOL AND FAMILY
SERIES.

BY
MARCUS WILLSON,
AUTHOR OF PRIMARY HISTORY; HISTORY OF THE
UNITED STATES; AMERICAN HISTORY; AND
OUTLINES OF GENERAL HISTORY.

Published by
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1863.



TO THE TEACHER.

O'er wayward childhood wouldst thou hold firm rule',
And sun thee in the light of happy faces',
Love', Hope', and Patience', — these must be thy graces';
And in thine *own*' heart' let them first keep school'.

For as old Atlas on his broad neck places
Heaven's starry globe', and there sustains it', so
Do these upbear the little world below
Of education'—Patience', Love', and Hope'.
Methinks I see them group'd in seemly show',
The straiten'd arms upraised', the palms aslope',
And robes that touching as adown they flow,
Distinctly' blend', like snow emboss'd in snow'.
Oh part them never'! If Hope prostrate lie',
Love too will sink and die'.

But Love is subtle', and doth proof derive
From her *own* life' that Hope is yet alive';
And bending o'er', with soul-transfusing eyes',
And the soft murmurs of the mother dove',
Woos back the fleeting spirit', and half supplies';
Thus Love repays to Hope' what Hope first gave to Love'.
Yet haply there will come a weary day,

When, overtask'd at length,
Both Love and Hope beneath the load give way'.
Then with a statue's smile', a statue's strength',
Stands the mute sister, Patience', nothing loth',
And both supporting', does the work of both'.

COLERIDGE.

Education

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P R E F A C E.

The FIFTH READER of the "School and Family Series" more fully develops the plan of the author than the preceding numbers. While we have aimed to compile a series of books in every respect adapted to give all needed instruction in the *art of reading*, we have also endeavored to make them the medium of conveying, in as interesting a form as possible, a large amount of useful knowledge; and it is with a great degree of confidence that all practical educators will acknowledge the possibility of harmonizing these two objects in a reading-book for schools, that the present volume is submitted to them. What better *reading-lessons* could be given than the numerous poetical extracts which are used to *illustrate* the lessons in BOTANY, where we find such gems as "The Moss Rose" (p. 150); Roscoe's address to "The Camellia" (p. 154); Leigh Hunt's "Chorus of Flowers" (p. 157); Mrs. Southey's "Night-blooming Cereus," or "Unpretending Worth" (p. 159); Dickens's "Ivy Green" (p. 163); Emerson's "Rhodora" (p. 171); Mary Howitt's "Corn-fields" (p. 194); that fine moral story of "The Fern and the Moss," by Eliza Cook (p. 201); and Longfellow's tribute to the "Drifting Sea-weed" (p. 210)? And why should not Holmes's beautiful description of "The Living Temple" (see p. 85) be both a more *useful* and a more *interesting* reading exercise when appropriately made a lesson in PHYSIOLOGY than when read as an isolated piece, dissevered from its natural connections? And where can be found better reading exercises than such as we have used to illustrate and give interest to PHYSICAL GEOGRAPHY, among which are found Mrs. Sigourney's description of "The Coral Insect" (p. 371); Bryant's description of mountain scenery, and of "The Prairies" (p. 372, 379); Willis Gaylord Clark's address to "The Alps" (p. 375); Prentice's "Mammoth Cave" (p. 384); Coleridge's "Valley of Chamouni" (p. 388); Proctor's, and Percival's, and Byron's descriptions of "The Ocean" (p. 394-7); and the several descriptions given of the "Falls of Niagara" (p. 405-7)? Such selections, every one must admit, are far more interesting and instructive when they are used to illustrate, and are themselves illustrated by, important facts and principles in science, than when they appear in miscellaneous collections merely as "Orient pearls at random strung." It is only when the *subjects* to which they refer are understood that such pieces are duly appreciated.

As *variety*, within the limits of good style, and embracing both prose and poetry, is correctly considered an essential requisite of a good reading-book for advanced pupils, we may justly urge that the *plan* of the present work has peculiar advantages in this respect; for not only do the illustrative selections to which we have alluded give great variety to the scientific divisions, but each of these departments of knowledge has a *literature of its own*; each has its peculiar words, and its forms of expression, as well as its principles, with which not only every scholar, but every general reader

should be familiar, but none of which would be presented in a *miscellaneous* reading-book that should omit all notice of the subjects themselves. But, to meet all possible demands for suitable variety, we have given "Miscellaneous Divisions" also, and in these have endeavored to make good whatever may be wanting in the more scientific portions. In Part I. we have given a pretty full elucidation of some of the higher principles of elocution, with abundant examples for illustration; and in Part XI. we have made such a selection of reading-lessons, in great part poetical, as will present, in chronological order, the outlines of Ancient History.

Of the amount of useful knowledge which the plan adopted in these reading-books is calculated to impart, we need only remark that we have aimed to present the leading truths of science in a form as attractive as possible, and have therefore avoided the dry details and technicalities which would have been required in a complete scientific text-book. Our object has been to present a pleasing *introduction* to science rather than to give any thing like a full exposition of any one department. The great mass of pupils in our schools know nothing whatever of many of the subjects here treated, nor is there any possibility of their becoming acquainted with them by any other method than by the one here adopted. It is thought, if *all* the pupils in our schools should acquire *some* knowledge of these subjects while attending to their ordinary reading-lessons, and become interested in the wonderful truths with which they abound, they will, in most instances, be stimulated to seek a farther acquaintance with them, and that the foundations may thus be laid for a wider dissemination of scientific knowledge, and a higher degree of popular education than has hitherto been thought attainable.

We might refer to the Natural History illustrations in the present volume as surpassing any thing of the kind ever before published in this country; but while their beauty—for which we are indebted to the pencil of a *Parsons*—will be acknowledged by all, it is their *utility*, as objects of interest and instruction to pupils, to which we would more particularly call attention; for not only does an accurate and striking illustration of an object often give a more correct idea of it than pages of description, but so maps it upon the memory that, by the most interesting of all associations, the very description itself is indelibly pictured there. The admirable system of "*object teaching*," whose principles should be carried throughout the entire educational course of every individual, could scarcely receive better aids than those furnished in the illustrations here given.

For valuable aid in several of the scientific divisions of the present work, it affords me pleasure here, as in the preceding volume, to acknowledge my indebtedness to Prof. N. B. Webster, of Virginia; and while doing this I would take occasion to express the hope that, however much the citizens of different states and sections may differ in their political views, in the sacred cause of science and popular education they may ever be united.

M. WILLSON.

NEW YORK, May 15th, 1861.

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EXPLANATION OF THE CHARACTERS USED IN CONNECTION WITH THE BOTANICAL DESCRIPTIONS.—In the botanical descriptions, the botanical name of the plant is first given in *italics*; then follow the common name, Linnæan class, Linnæan order, native color of blossom (or of plant when it has no blossom), ordinary height or length of plant, and native country. r. designates red, pk. pink, w. white, or. orange, pu. purple, y. yellow, cr. cream, s. or sc. scarlet, g. or gr. green, br. brown, li. lilac, lem. lemon; ap. means apetalous, or flowerless. The months are designated as follows, beginning with January: J., F., M., A., My., Jn., Jl., Au., S., O., N., D.

For the "Pronouncing Key" and "Alphabetical List of Authors," see end of the volume.

PART I.

ELOCUTIONARY.

I. ELEMENTS OF ELOCUTION.

INFLECTIONS.

THE character of the inflections, or slides of the voice, and the marks used to designate them, were briefly explained in the Second Reader of this series.

Instead of placing the marks of the inflections over the *accented* syllables of inflected words, or over the *emphatic* words, as most writers on Elocution have done, we have *generally* placed them at the *end* of the inflected word or clause. As accent and emphasis are entirely distinct from inflection, there seems to be no good reason for uniting them; and, indeed, it often happens that the *accented syllable* of a word is not the one which is inflected. Thus, in the example, "Did he answer *satisfactorily*?" as usually spoken, the voice does not begin to rise until it has pronounced the *accented syllable*; and in the example, "Did he resemble his *father*," or his *mother*?" in which Dr. Porter, in his excellent work, places the inflections over the *accented syllables* of the inflected words, it is very certain that the *closing* syllables have the greatest degree of inflection; and that, in the word "*father*," the *accented syllable* is not inflected at all, but is pronounced in the *same* tone as the preceding part of the sentence.

As an *emphatical* word usually bears the same rhetorical relation to the clause in which it is placed as the *accented syllable* does to the word of which it forms a part, so there is no more propriety in placing the mark of inflection over an *emphatic* word than over an *accented syllable*. Therefore, in the following examples,

Did he show *compassion* for me' ?
To what place shall I *betake* myself ?

we would place the inflections at the close of the sentences. We thus avoid confounding emphasis with inflection, an error which has led many learners astray; and if we *emphasize* the words "*compassion*" and "*betake*," we shall be sure to give them the right tone if we keep in view the inflections at the close.

We would give the following rules for the position of the marks of inflection :

1st. When the entire rising or downward slide, or much the greater part of it, occurs on an *emphatic* word, and is not continued to the end of the clause or sentence, the mark may be placed at the end of such inflected word, as :

I *dare*' accusation. I *defy*' the honorable gentleman.

2d. When the rising, or the downward slide, wherever it occurs, is con-

tinued to the end of a clause, so that the greatest rise or fall is at the end, the mark should be placed at the end, as in the following :

Charity *envieth* not'; charity *vaunteth* not itself'; *is* not puffed up'.

In this example the downward slide begins at *en*, *vaun*, and *is*, and is continued to the end of each member respectively, where is the greatest extent of the slide.

A very satisfactory reason for placing the mark of inflection at the end of "not," rather than over the accented syllable of "*envieth*," is, that it is a guide to the correct pronunciation of the sentence in the former case, but no guide at all in the latter case; for if it be placed over "*envieth*," the end of the sentence may, nevertheless, have the rising inflection, as in the example:

Charity *envieth* not'; but is kindly disposed to all'.

Here *envieth* is pronounced the same as in the former case, and yet the rising inflection is required at the end of the clause, while the downward inflection is required in the former case. For the *mark* to be a *correct guide*, it must be placed at the end of the clause in both cases.

ELEMENTARY RULES.

"*Speak clearly, if you speak at all;
Carve every word before you let it fall;
Don't, like a lecturer or dramatic star,
Try over hard to roll the British R;
Do put your accents in the proper spot;
Don't—let me beg you—don't say "How?" for "What?"
And when you stick on conversation's burrs,
Don't strew the pathway with those dreadful urs.*"—O. W. HOLMES.

RULE I.—Direct questions, or those that can be answered by yes or no, generally require the rising inflection, and their answers the falling.

EXAMPLES.—Do you think he will come to-day'? No'; I think he will not'.—Was that Henry'? No'; it was John'.—Did you see William'? Yes', I did'.—Are you going to town to-day'? No', I shall go to-morrow'.

MODIFICATIONS OF RULE I.

NOTE I.—Answers that are given in a careless or indifferent manner, or in a tone of slight disrespect, take the rising inflection in all cases.

EXAMPLES.—Did you see William'? I did'.—What did he say to you'? Not much'. See, also, Lesson II., p. 39, of Second Reader.

NOTE II.—Direct questions, when they have the nature of an appeal, or are spoken in an exclamatory manner, take the *falling* inflection. In these cases the voice often falls *below* the general pitch, contrary to the general rule for the falling inflection.

EXAMPLES.—Is not that a beautiful sight'?—Will you persist in doing it'?—Is it right'?—Is it just'?

Was ever woman in this humor wooed'?
Was ever woman in this humor won'?

NOTE III.—When a direct question is not understood, and is *repeated* with emphasis, the repeated question takes the falling inflection.

EXAMPLES.—Will you speak to him to-day'? If the question is not understood, it is repeated with the falling inflection, thus: Will you speak to him to-day'?—Are you going to Salem'? I said, Are you going to Salem'?

RULE II.—The pause of *suspension*, denoting that the sense is unfinished,

such as a succession of particulars that are *not emphatic*, cases of direct address, sentences implying condition, the case absolute, etc., generally requires the rising inflection.

EXAMPLES.—John', James', and William', come here'.—The great', the good', the honored', the noble', the wealthy', alike pass away.

Friends', Romans', countrymen', lend me your ears.

Jesus saith unto him, Simon', son of Jonas', lovest thou me'?

Ye hills', and dales', ye rivers', woods', and plains',

And ye that live and move, fair creatures', tell',

Tell, if ye saw, how came I thus'; how here'?

NOTE.—For cases in which *emphatic* succession of particulars modifies this rule, see Rule VIII.

RULE III.—Indirect questions, or those which can not be answered by yes or no, generally require the falling inflection, and their answers the same.

EXAMPLES.—When did you see him'? Yesterday'.—When will he come again'? Tomorrow'.

Who say the people that I am'? They answering, said, John the Baptist'; but some say Elias'; and others say that one of the old prophets' is risen again.

NOTE.—But when the indirect question is one asking a *repetition* of what was not at first understood, it takes the *rising* inflection. "What did he say'?" is an indirect question, with the falling inflection, asking for information. But if I myself *heard* the person speak, and did not fully understand him, and then ask some person to *repeat* what he said, I give my question the *rising* inflection, thus, "What' did he say'?" (Remark.—Perhaps the true reason of the rising inflection here on the word *say* is because it is preceded by an emphatic word (what) with the falling inflection. See note to Rule IV.)

RULE IV.—A completion of the sense, whether at the close or any other part of the sentence, requires the falling inflection.

EXAMPLES.—He that saw me' saw you also', and he who aided me once' will aid me again'.

In the beginning, God created the heavens and the earth'. And the earth was without form, and void'; and darkness was on the face of the deep': and the spirit of God moved upon the face of the waters'.

NOTE.—But when strong emphasis, with the falling inflection, comes near the close of a sentence, the voice often takes the rising inflection at the close.

EXAMPLES.—If William does not come, I think John' will be here'.—If he *should* come, what' would you do'?

CASSIUS. What night is this?

CASCA. A very pleasing night to honest' men'.

Proceed', I am attentive'.

This is the course rather of our enemies, than of friends' of our country's liberty'.

If the witness does not believe in God, or a future state, you can not swear' him'.

RULE V.—Words and clauses connected by the disjunctive *or*, generally require the rising inflection before the disjunctive, and the falling after it. Where several words are thus connected in the same clause, the rising inflection is given to all except the last.

EXAMPLES.—Will you go' or stay'? I will go'.—Will you go in the buggy', or the carriage', or the cars', or the coach'? I will go in the cars'.

He may study law', or medicine', or divinity'; or', he may enter into trade'.

The baptism of John, was it from heaven', or of men'?

Did he travel for health', or for pleasure' ?
Did he resemble his father', or his mother' ?

NOTE I.—When the disjunctive *or* is made emphatic, with the falling inflection, it is followed by the rising inflection, in accordance with the note to Rule IV.; as, "He *must* have traveled for health, *or*' pleasure'."

EXAMPLES.—He must either *work*', or' study'.—He must be a *mechanic*, or' a lawyer'.
—He must get his living in *one* way, or' the other'.

NOTE II.—When *or* is used *conjunctively*, as no contrast is denoted by it, it requires the *rising* inflection *after* as well as before it, except when the clause or sentence expresses a *completion* of the sense.

EXAMPLE.—Did he give you money', or food', or clothing' ? No', he gave me nothing'.

RULE VI.—When *negation* is opposed to *affirmation*, the former takes the rising and the latter the falling inflection, in whatever order they occur. Comparison and contrast (antithesis) come under the same head.

EXAMPLES.—I did not *hear* him', I *saw* him'.—I said he was a good soldier', not' a good citizen'.—He will not come to-day', but to-morrow'.—He did not call me', but you'.—He means dutiful', not undutiful'.—I come to *bury* Cæsar', not to *praise* him'.

This is no time for a tribunal of justice', but for showing mercy'; not for accusation', but for philanthropy'; not for trial', but for pardon'; not for sentence and execution', but for compassion and kindness'.

Comparison and Contrast.—Homer was the greater genius', Virgil the better artist'; in the one we most admire the man', in the other the work'.—There were tyrants at home', and robbers abroad'.

By honor' and dishonor'; by evil report' and good report'; as deceivers', and yet true'; as unknown', and yet well known'; as dying', and behold we live'; as chastened', and not killed'; as sorrowful', yet always rejoicing'; as poor', yet making many rich'; as having nothing', yet possessing all things'.

When our vices leave us', we flatter ourselves we leave *them*'.

The prodigal robs his *heir*', the miser robs *himself*'.

NOTE I.—Negative sentences which imply a continuance of thought, although they may not be opposed to affirmation, frequently close with the rising inflection; as,

True politeness is not a mere compliance with arbitrary *custom*'.

Do not suppose that I would *deceive* you'.

These things do not make your *government*'.

This is nearly allied in character to Rule IX.; and such examples as those under Note I. may be considered as expressive of *tender* emotion, in opposition to *strong* emotion. Affirmative sentences similar to the foregoing require the rising inflection, in accordance with Rule IX., when they express *tender* emotion; as,

I trust you will *hear* me'. I am sure you are mistaken'.

But, sir, the poor must not starve'; they must be taken care of'.

NOTE II.—When, in contrasted sentences, negation is attended with deep and calm feeling, it requires the falling inflection.

EXAMPLE.—We are perplexed', but not in despair'; persecuted', but not forsaken'.

RULE VII.—For the sake of variety and harmony, the last pause but one in a sentence is usually preceded by the rising inflection.

EXAMPLES.—The minor longs to be of age'; then to be a man of business'; then to arrive at honors'; then to retire'.

Time taxes our health', our limbs', our faculties', our strength', and our features'.

NOTE.—The foregoing rule is sometimes departed from in the case of an emphatic succession of particulars, for which, see Rule VIII.

In the second preceding example, the rising inflection is given to the words *health, limbs, faculties, and strength*, both because they are *not* attended with strong emphasis, and because they *are* followed by the pause of suspension, in which the mind anticipates a continuation of the sentence.

RULE VIII.— 1st. *A Commencing Series.*

In an *emphatic series of particulars*, where the series begins the sentence, but does not either end it or form complete sense, every particular *except the last* should have the falling inflection.

EXAMPLE.—Our disordered hearts', our guilty passions', our violent prejudices', and misplaced desires', are the instruments of the trouble which we endure.

2d. *A Concluding Series.*

When the series ends the sentence, or forms complete sense, every particular in the series, *except the last but one*, should have the falling inflection; and, indeed, *all* should have it, if the closing member of the series is of sufficient length to admit a pause with the rising inflection, before the end.

EXAMPLE.—Charity suffereth long', and is kind'; charity *envieth* not'; charity *vaunteth* not itself'; is not puffed up'; doth not behave itself *unseemly*'; seeketh not her own'; is not easily *provoked*'; thinketh no *evil*'.

NOTE.—The degree of emphasis, and often of solemnity, with which the successive particulars are mentioned, decides, in cases of the pause of suspension (see Rule II.), whether the rising or the falling inflection is to be used. Thus, a succession of particulars which one reader deems *unimportant*, will be read by him throughout with the rising inflection, while another, feeling more deeply, will use the falling inflection. Thus:

1. The birds sing', the lambs play', the grass grows', the trees are green', and all nature is beautiful'.

2. The blind see'; the lame walk'; the lepers are cleansed'; the deaf hear'; the dead are raised'; and to the poor', the gospel is preached'.

In this example *all* the particulars have the falling inflection.

The first line in Mark Antony's harangue is read differently by equally good readers; but the difference arises wholly from their different appreciation of the spirit and intention of the speaker. Thus:

Friends', Romans', countrymen', lend me your ears'!

Friends', Romans', *countrymen*', lend me your ears'!

If Antony designed to characterize "countrymen" with peculiar emphasis, he gave it the *falling* inflection, otherwise he gave the word no greater prominence than the preceding words "friends" and "Romans."

RULE IX.—Expressions of *tender* emotion, such as grief, pity, kindness, gentle joy, a gentle reproof, gentle appeal, gentle entreaty or expostulation, etc., commonly require a gentle *rising* inflection.

EXAMPLES.—Mary'! Mary'! do' not do so'.

My mother'! when I learned that thou wast dead',

Say', wast thou conscious' of the tears' I shed'?

Hovered thy spirit o'er thy sorrowing son',

Wretch even then', life's journey just begun'?

I would not live away'; I ask not to stay,

Where storm after storm rises dark o'er the way';

I would not live away, thus fettered by sin';

Temptation without, and corruption within';—

Is your father' well', the old man' of whom ye spake'? Is he' yet alive'?

RULE X.—Expressions of *strong* emotion, such as the language of exclamation (not designed as a question), authority, surprise, distress, denunciation, lamentation, earnest entreaty, command, reproach, terror, anger, hatred, envy, revenge, etc., and strong affirmation; require the *falling* inflection.

EXAMPLES.—What a piece of work is man! How noble in reason! how infinite in faculties! in action, how like an angel! in apprehension, how like a God!

My lords, I am *amazed*; yes, my lords, I am *amazed* at his Grace's speech.

Woe unto you Pharisees! Woe unto you Scribes!

You blocks, you stones, you worse than senseless things!

Go to the ant, thou sluggard; consider her ways, and be wise.

Jesus saith unto her, Mary. She turned herself, and said unto him, *Rabboni*.

I tell you, though *you*, though all the *world*, though an angel from *heaven* should declare the truth of it, I could not believe it.

I *dare* accusation. I *defy* the honorable gentleman.

I'd rather be a *dog*, and bay the *moon*, than such a Roman.

CAS. O ye *gods*! ye *gods*! must I endure all this?

BRU. All this? ay, and *more*.

NOTE.—When exclamatory sentences become questions they require the *rising* inflection.

EXAMPLES.—What are you saying!—Where are you going!

They planted by *your* care! No! your oppressions planted them in America!

THE CIRCUMFLEX OR WAVE.

RULE XI.—Hypothetical expressions, sarcasm, and irony, and sentences *implying* a comparison or contrast that is not fully expressed, often require a union of the two inflections on the same syllable.

EXPLANATION.—In addition to the rising and falling inflections, there is what is called the *circumflex* or *wave*, which is a union of the two on the same syllable. It is a significant twisting or waving of the voice, generally first downward and then upward, but sometimes the reverse, and is attended with a sensible *protraction* of sound on the syllable thus inflected. It is marked thus: (˘) as, "I may possibly go to-morrow, though I can not go to-day." "I did it myself, sir. Surprising! *You* did it!"

EXAMPLES.—If the *righteous* scarcely be saved, where shall the ungodly and the sinner appear?

I grant you I was *dōwn*, and out of breath; and so was he.

And but for these vile *gūns*, he would himself have been a soldier.

QUEEN. Hamlet, you have your father much offended.

HAMLET. Madam, *yōu* have my father much offended.

SHYLOCK. If it will feed nothing else, it will feed my *revēnge*.

Hath a *dōg* money? Is it possible a *cūr* can lend two thousand ducats?

They tell *ūs* to be moderate; but *thēy*, *thēy* are to revel in profusion.

You pretend to reason? You don't so much as know the first elements of reasoning.

NOTE.—A nice distinction in sense sometimes depends upon the right use of the inflections.

EXAMPLES.—"I did not give a sixpence'."

"I did not give a sixpence'."

The circumflex on *sixpence* implies that I gave more or less than that sum; but the falling inflection on the same word implies that I gave nothing at all.

"Hume said he would go twenty miles to hear Whitefield preach," (here the circumflex implies the contrast), "but he would take no pains to hear an ordinary preacher."

"A man who is in the daily use of ardent spirits, if he does not become a drunkard, is in danger of losing his health and character."


The rising inflection on the closing syllable of *drunkard* would pervert the meaning wholly, and assert that, in order to preserve health and character, one must become a drunkard.

"The dog would have died if they had not cut off his head."

The falling inflection on *died* would make the cutting off his head necessary to saving his life.

A physician says of a patient, "He is better'." This implies a positive amendment. But if he says, "He is bëtter'," it denotes only a partial and perhaps doubtful amendment, and implies, "But he is still dangerously sick."

THE MONOTONE.

RULE XII.—The *monotone*, which is a succession of words on the same key or pitch, and is not properly an inflection, is often employed in passages of solemn denunciation, sublime description, or expressing deep reverence and awe. It is marked with the short horizontal dash over the accented vowel.  It must not be mistaken for the *long sound* of the vowels, as given in the Pronouncing Key.

EXAMPLES.—And one cried unto another, and said, Hôly, hôly, hôly is the Lôrd of hôsts. The whole êarth is full of his glôry.

Blessing, hônor, glôry, and pôwer be ûnto him that sitteth on the thrône, and to the Lâmb forêver and êver.

In thoughts from the visions of the night, when dêep slêep fülleth on mên, fear câme upôn me, and trëmbing which mâde all my bônes to shake. Thên a spîrit passèd before my face; the hàir of my flesh stôod ûp. It stôod still, but I còuld not discêrn the fôr'm therêof: an image was before my êyes, there was silence, and I heard a vóice, sâying, Shâll mór'tal mân be môre júst than Gôd? Shâll a mân be môre pûre than his Mâker?

EMPHASIS.

Emphasis is a forcible stress of voice upon some word or words in a sentence on account of their significancy and importance. Sometimes it merely gives *prolonged loudness* to a word, but generally the various inflections are connected with it. Thus it not only gives additional *force* to language, but the sense often depends upon it.

EXAMPLES.—I did not say he struck *mé*; I said he struck *John*'.

I did not say he *struck* me; I said he *pushed* me.

I did not say *hé* struck me; I said *Jôhn* did.

I did not *sây* he struck me; but I *wrôte* it.

I did nôt say he struck me; but *Jôhn* said he did.

He that can not *bedr* a jest, should never *make*' one.

It is not so easy to *hîde* one's faults as to *mend* them.

CASSIUS. I may do that I shall be sorry for.

BRUTUS. You *have*' done that you *shôuld* be sorry for.

(The varied effects of *emphatic stress* and *emphatic inflection* are so fully shown in the Reading Lessons of all the Readers as to need no further illustration.)

II. HIGHER PRINCIPLES OF ELOCUTION.

A SERIES OF CONVERSATIONS,

IN WHICH SOME OF THE HIGHER PRINCIPLES OF ELOCUTION ARE DEVELOPED.

FIRST EVENING.

ANALYSIS.—Modifications of general rules, owing to the great variety of emotions, passions, and feelings, which language is designed to express. Direct questions whose answers take the rising inflection. Examples. No one can be a correct reader without a correct appreciation of what he reads. When good readers will read the same passage differently. Questions that contain an appeal. The inflections in spoken language. Why printed language is a very imperfect representation of spoken language. Importance of the inflections in obscure passages.

Bernardo. Well', Crito', I believe we agreed to devote the evenings of *this* week to an examination of some of the higher principles of Elocution. At what point shall we begin'?

Crito. As I have met with some difficulties in what are called the "Elements of Elocution," perhaps it would be well to take up these first.

Bernardo. By all means. Let us know what these difficulties are, that we may remove them, if possible.

Crito. In the first place, I would ask, as introductory, why there should be so many modifications, by way of notes and exceptions, of the Rules laid down in the "Elements?"

Bernardo. The answer is very easy. It is owing to the great variety of emotions, passions, and feelings, which written language is designed to express. Plain and simple language, which has but little variety, requires but few rules. Thus, in the case of plain *direct* questions, without emotion, if the answers are plain and simple also, they will in all cases take the falling inflection. Look at the examples given under the Notes to Rule I. Do you not see that all of them are, more or less, the language of passion or emotion'?

Crito. I had not thought of it before; but I see it is so. I suppose', then', the reason for every departure from Rule I., in the case of direct questions, is to be found in the *nature* of the passion or feeling which is designed to be expressed.

Bernardo. Exactly so'. Depend upon it, if the answer to a direct and simple question does not take the falling inflection', it is because something *more* than a plain and direct answer is contained in the reply.

Crito. I was puzzled, a few days ago, to find a rule for the inflection which I heard given, in a political debate, to several answers to direct questions. The following are the examples:

Mr. A. Did not you vote for Harrison'?

Mr. B. To be sure I did'; but has that any thing to do with the question'?

Mr. A. Certainly it has'. Does it not show that you belong to the Republican party'?

Mr. B. Not at all, sir'. I belonged to the Whig party *then*', and I advocate the same principles *now*'. Can you say as much—that you have not changed both party and principles too'?

Mr. A. Most assuredly I can'.

Here the answers take the rising inflection; and I suppose the principle, or rule, is to be found in the first Note under Rule I.

Bernardo. You are correct. The answers are given with a feeling, and in a tone of self-assurance, that may be considered as approaching to

"slight disrespect." Yet this style becomes monotonous and tiresome if carried too far; and I think it would have been better if Mr. A. had dropped the *taunt* in his last reply, and answered in a tone of dignified candor, which would have required the falling inflection at the close. You will find a good example of the rising inflection required in the answer to both kinds of questions in the following dialogue, from Shakspeare, between the villain Iago and Othello. Observe Othello's answer with the rising inflection, "He did';" also the effect of the assumed indifference, or pretended careless absent-mindedness of Iago, in giving to several of his answers the rising inflection:

Iago. My noble lord'—

Othello. What dost thou say',¹ Iago'?

Iago. Did Michael Cassio, when you woo'd my lady, know' of your love'?

Oth. He did', from first to last': why dost thou ask'?

Iago. But for a satisfaction of my thought':²

No further harm'.

Oth. Why of thy thought', Iago'?

Iago. I did not think he had been acquainted' with it.

Oth. Oh' yes', and went between us very oft.

Iago. Indeed'?

Oth. Indeed'! ay, indeed'³ Discern'st thou aught in that'?

Is he not honest'?

Iago. Honest', my lord'?

Oth. Ay, honest'.

Iago. My lord, for aught I know'.

Oth. What dost thou think'?

Iago. Think', my lord'?

Oth. Think, my lord? By heaven he echoes me

As if there were some monster in his thoughts

Too hideous to be shown.

Crito. How much the beauty of such a piece depends upon the manner of reading' it! One can almost look into the very heart of Othello, and see the first awakening of a suspicious nature, as, startled by Iago's "Indeed'?" he repeats the word after him in a manner that indicates how easily his jealousy may be fully aroused.

Bernardo. Yes; and this passage from Shakspeare not only furnishes a fine illustration of the principle referred to in Note I., under Rule First, but is a fine reading exercise also, on account of other nice points contained in it. Both the cunning treachery of Iago, and the gradually awakened suspicion in the breast of the honest Othello of a something wrong, must be fully appreciated by one who would read the passage well. Unpremeditated language seldom fails to give a truthful expression of the feelings; but when *we read* this language of another, we must fully enter into his feelings if we would as truthfully express all that he intended. You see', therefore, *Crito'*, that in order to read Shakspeare *well'*, one must fully enter into, and thoroughly understand, the *characters* represented.

Crito. This gives me some new ideas of the art of reading; for it appears, from what you say, that if we would correctly express the thoughts and feelings of another', we must first know precisely what those thoughts and feelings are'; and that no one can read well', unless he reads understandingly'. Truly, this view of the subject, while it shows the difficulties in the way of good reading, elevates reading to the dignity of one of the Fine Arts. But', let me ask', can not one *imitate* good reading', so as to read correctly, even without a correct understanding of what he reads?

Bernardo. To some extent one may; as one may learn, parrot-like, to

¹ For the rising inflection to "say," see Note to Rule III.

² Note 1 to Rule I.

³ Surprise: Rule X.

utter words without meaning. But such a person could never be sure of reading a new piece, or even a single sentence, correctly. The chief reason why so many are poor readers is, either they do not fully *understand* what they read, or they do not fully enter into its spirit while reading. You may lay this down as a principle: that *no one can be a correct reader without a correct appreciation of what he reads.*

Crito. Then I should suppose that if two persons have precisely the same understanding of a passage, both ought to read it in the same manner.

Bernardo. Certainly they ought, in all important particulars; and, if they read it differently—one, for example, with the marked rising inflection where the other uses the falling, it must be either because both do not attach precisely the same meaning to it, or because one of them reads it erroneously.

Crito. And yet I have in my mind an example of a direct question which I have heard asked with the falling inflection at the close, and which, it appears to me, might as well have taken the rising slide. It is this. One morning William was told by his father that he must do a certain piece of work in the garden. At noon he was again reminded that the work must be done, when William asked, "Must the work be done to-day?" giving to the question the falling inflection, whereas he might have given it the rising. But if the same question may be asked with one inflection as well as with the other, I do not see that the rule is of any use.

Bernardo. One very important use of it, and of the notes under it, is to lead you to notice *what it is* that causes the falling inflection to be given to the question in this particular case, in violation of the general rule. Did William merely ask the question for information? or did he connect with it something like a fretful appeal to his father that the work might be deferred?¹

Crito. The latter, I suppose. Do you mean to say, then, that it is *because* William's question had in it "the nature of an appeal," that it takes the falling inflection, in opposition to the general rule?

Bernardo. That is precisely what I mean. Nature has adopted the falling inflection in this case to show that the question contains this appeal. The rising inflection would not have shown it. You can try it, and you will at once see the difference.

Crito. But if I find this same question in a book, how do I know, from the mere words (as they are the same in one case as in the other), whether William spoke it pleasantly, or fretfully?²

Bernardo. We do not always know, unless the mark of inflection is given as a guide. In *spoken* language, the inflections in such cases are always correctly used, even by children; and they are always correctly understood by the hearer.

Crito. Then why should they not be used in written or printed language? Would not the language thereby more plainly express the meaning intended?

Bernardo. Without doubt it would; and if Shakspeare, throughout all his plays, had marked the inflections as he wished the passages spoken, he would have made all his characters so well understood that the critics would have been saved a great amount of controversy. Our printed language is, at the best, a very imperfect representation of spoken language.

¹ See Rule V., also Rule III., for the downward slide here, as the question does not admit a categorical answer, yes or no.

To be any thing like perfect, it must represent not only the *words* generally, but *all* their varied modulations, tones, and inflections, accent, and emphasis, and a great variety of rhetorical pauses which now are not designated at all. Some of these things, indeed, are not essential to a correct understanding of the *meaning* of printed language, however much they would exemplify its force and beauty; but I am of the opinion that it would be better if the *inflections* at least were inserted in all cases where their omission, as in the example of William's answer, renders the sense obscure. No valid objection could be made to so small, and, at the same time, so useful an innovation as this. More than this would, perhaps, be undesirable.

SECOND EVENING.

ANALYSIS.—The *pause* of suspension, with the rising or the falling slide. A prolonged *horizontal* suspension of the voice. Rhetorical pauses, as distinguished from grammatical or *sentential* pauses. The rhetorical pause proper: when used, and its effect. Examples: Patrick Henry's speech—the Earl of Chatham—Dr. Nott—Pope. Other cases of pause where none is allowed in the grammatical construction. The rhetorical pause used in cases of contrast. Example from Cicero—from Dr. Blair. A contrast in sentiment requires contrast in voice. Prolonged utterance of words in certain cases. Proper management of the voice.

Crito. Since our last conversation, I have been examining the Second Rule in connection with the Eighth, and I find it stated that in certain cases the *pause of suspension* takes the rising inflection, and in others the falling. It has occurred to me that there might be a pause of suspension that takes neither the rising nor the falling slide, but I have found no notice of such. Is not such a pause frequently used in reading or speaking?—a kind of prolonged *horizontal* suspension of the voice?

Bernardo. There is, indeed, such a pause—a rhetorical pause proper it should be called; and a judicious use of it is, next to a correct use of the inflections, one of the greatest beauties in reading. The hyphen or dash (—) sometimes indicates it, but not always; and the dash, moreover, is used with both kinds of inflections.

Crito. Are not all the pauses—such as the comma, colon, semicolon, and the marks of interrogation and exclamation, *rhetorical* pauses?

Bernardo. With the exception of the marks of interrogation and exclamation, I should say they are not, properly speaking, as their primary object is to mark the divisions of a sentence, and show its grammatical construction. I should call them grammatical or *sentential* pauses. Moreover, these pauses are so far from being sufficient or accurate guides to the reader, that an obsequious attention to them is one cause of the heavy, monotonous style of reading into which most persons fall, and which it is so difficult to correct. The marks of interrogation and exclamation, the parenthesis, and the hyphen or dash, however, are wholly rhetorical, as they denote no grammatical relation, and have no established length. The rhetorical pause proper, which is sometimes, but not always, denoted by the hyphen, is perhaps the only one of these that requires any special attention.

Crito. I would like to know more of the character of this rhetorical pause, and the principles on which it is based. Will you explain it, and give me some examples of its use?

Bernardo. The rhetorical pause proper is used, first, where there is an abrupt suspension of the line of thought, for the purpose of giving place to some new suggestion; and, secondly, it is used either before or after something very striking or significant is uttered. In the latter case, the effect is, by holding the hearer momentarily in suspense, suddenly to arrest his at-

tention, for the purpose of directing it with greater force to the emphatic word or clause.

Crito. I think, from your description, it is this pause which I have heard appropriately used in the concluding sentence of Patrick Henry's famous speech:

I know not what course *others* may take', but as for me, give me liberty, or give me death'!

Bernardo. This is correct. Here this pause is used three times, but with the greatest force before the closing emphatic word—"death." Another fine example of it is found in the Earl of Chatham's speech on the repeal of the Stamp Act. He is reported to have spoken as follows, alluding to the ministry who had been opposed to the repeal:

Some of them have done me the honor to ask my poor opinion before they would engage to repeal the act. They will do me the justice to own I did advise them to engage to do it; but, notwithstanding, for I love to be explicit, I can not give them my confidence. Pardon me, gentlemen, confidence is a plant of slow growth.

Here this rhetorical pause is used several times, in some instances in connection with the grammatical pauses; but the one which is the most marked of all is used where no other pause is designated. The concluding words, after this pause, are to be spoken slowly, and with marked emphasis.

Crito. I recollect a passage in Rev. Dr. Nott's discourse on the death of Hamilton which requires a similar rhetorical pause in reading. I allude to the following:

I would uncover the breathless corpse of Hamilton, I would lift from his gaping wound his bloody mantle, I would hold it up to heaven before them, and I would ask—in the name of God I would ask—whether at the sight of it they felt no compunction.

Here, evidently, great force is given to the concluding words by a protracted rhetorical pause after the emphatic pronoun *it*.

Bernardo. Let me give one example more, which is from Pope's Essay on Man:

Know then thyself: presume not God to scan:
The proper study of mankind is MAN.

As intimately connected with this subject, I would remark that good readers often give a slight rhetorical pause, or rest, in some other cases also, where no pause is designated, and where none is allowed in the grammatical construction. Especially does this occur where the speaker would fix attention on a single word that stands as immediate nominative to a verb, and also in antithetic or contrasted clauses. Thus, as an example of the first:

Some place the bliss in action, *some* in ease;
Those call it pleasure, and contentment these.

Every good reader will suspend the voice briefly, after each of these emphatic words, although no punctuation mark is found there.

Crito. You mentioned antithetic or contrasted clauses also. I observe that in some of the examples of "Comparison and Contrast," under the Sixth Rule, the same kind of pause is made, even where none is required in the grammatical construction. Thus I observe it after the words "Homer," "Virgil," "the one," "the other," etc.

Bernardo. I find a still better example in one of Cicero's orations, in which the orator is speaking of Pompey. In order to show the contrasted parts distinctly, it is desirable to make a longer pause between them than if there were no opposition in the sense. Thus:

He waged more wars than others had read; conquered more provinces than others

had governed'; and had been trained up from his youth to the art of war'; not by the precepts of others', but by his own commands'; not by miscarriages in the field', but by victories'; not by campaigns', but by triumphs'.

Here a pause of some length is required after *wars, provinces, others*, etc. I am tempted to give one more example, which I select, not only for its appropriateness in illustrating the principle under consideration, but also for the beauty of the sentiment. It is from Blair's sermon on Gentleness:

As there is a worldly happiness which God perceives to be no more than disguised misery'; as there are worldly honors which in his estimation are reproach', so there is a worldly wisdom which in his sight is foolishness. Of this worldly wisdom the characters are given in the Scriptures, and placed in contrast with those of the wisdom which is from above. The one is the wisdom of the crafty', the other that of the upright'; the one terminates in selfishness', the other in charity'; the one is full of strife and bitter envyings', the other of mercy and of good fruits.

Here the first two clauses should be pronounced in a somewhat elevated tone of voice; then, after a somewhat protracted pause at *reproach*, the voice should drop into a lower tone, with a slower pronunciation. The first members of the contrasted parts should be pronounced in a higher tone than the latter members. It may be well to recollect that this rule should be observed in all antithetic or contrasted clauses. A contrast in sentiments' requires contrast in voice'.

Crito. Very nearly allied to the kind of pause which we have been considering seems to be that *prolonged* pronunciation which good readers sometimes give to a word, without actually pausing after it. I have noticed this especially in the following beautiful extract from Pope, where the poet is speaking of the soul of God as seen throughout all nature.

Warm^s in the sun, refreshes^s in the breeze,
Glow^s in the stars, and blossoms^s in the trees,
Lives^s through all life, extends^s through all extent,
Spreads^s undivided, operates^s unspent.—POPE.

Bernardo. You have selected a fine illustration of an important principle. If we will notice our own conversation, or listen to any extempore speaking in which nature is followed, we shall find that while some words and clauses, apparently used as mere connectives, are quickly passed over, others, of more importance, are prolonged in the pronunciation. The proper management of the voice in this respect, so as to give to every word just the degree of importance to which it is entitled, is another of the beauties of good reading. The ways in which the voice manages to express every possible variety of thought are almost numberless. We can represent but few of them to the eye.

THIRD EVENING.

ANALYSIS.—Indirect questions that take the rising inflection. First example—not a completed sentence. Deceptive examples, which have the falling inflection, although they *appear* to have the rising. The questions *completed* in these examples. The rising inflection at the close of sentences: explained on the principle of the ordinary pause of suspension. The pause of suspension in inverted sentences. The rising inflection in cases of gentle entreaty or expostulation. Negation and affirmation. On what the inflections depend. They are *natural* signs of thought.

Bernardo. If you have met with any more points of difficulty', *Crito*', which relate to the Rules laid down in the "Elements," if you will bring them forward, we will consider them this evening; for there are some new principles to which I wish to call your attention in our subsequent conversations.

Crito. I shall be very glad, indeed, to have a few difficulties removed,

if it can be done. To begin, then: I have found several examples of indirect questions which I can not reconcile with Rule Third. Thus, in the following:

Question. Will he go'?

Ans. I think it doubtful'.

Question. Why not'?

The last question here is indirect; that is, it can not be answered by yes or no, and yet it is evident to me that it takes the rising inflection. I do not see that either the Rule', or the Note', provides for a case of this kind. Can you explain it'?

Bernardo. I think you yourself will discover, by a little reflection, that the example does not, in reality, violate the Rule. You will observe that the answer, "Why not'?" is not a *completed* sentence. What would the answer be if completed'?

Crito. Indeed, I did not think of that; but I can explain it now. The complete answer is, "Why will he *not'* go'?" which has the falling inflection.

Bernardo. Yes, you have given the correct explanation—partially so, at least. In nearly all cases the falling inflection *begins* at a point higher than the key-note; and in this case it strikes the word "not" on a high key, preparatory to its downward slide. *As soon* as the voice strikes it, however, it begins to fall; and, if I were to be critically correct, I should perhaps say this very word "not" is pronounced with the falling inflection. I admit that it *appears* to have the rising slide. In the word "doubtful'," in the same example, we find a parallel case, for the first syllable of it is struck on a high key, and might, with the same propriety as in the case of the word "not," have received the rising inflection.

Crito. But I have still another kind of indirect question, which I think can not be explained in this way. It is the following, which I recently heard an eloquent divine read, giving the rising inflection to all the questions:

How, then, shall they call on him in whom they have not believed'? and how shall they believe in him of whom they have not heard'? and how shall they hear without a preacher'? and how shall they preach except they be sent'?

Now, although these questions *may* be read with the falling slide, yet it seems very evident that they may also be read with the rising, with equal propriety.

Bernardo. And yet I think it may be maintained, with very good reason, that all these questions, even as you have read them, take the falling slide in the closing *syllable*, the voice merely striking the closing words at a high pitch, and then immediately falling. The word "preacher" is pronounced, in the example given, in a manner very different from what it is in the following example, "Is he a preacher'?" As the latter is plainly the rising inflection, it may well be doubted if the former is.

Crito. I perceive a difference; and yet I think most persons would consider that the examples given have the rising inflection. The voice certainly rises very high to strike the closing words; and its downward slide, if there be any, is scarcely perceptible.

Bernardo. If we should admit that these questions may be pronounced with the rising inflection as well as with the falling, then I should say that the *precise meaning*, or the force of the expression, can not be the same in both cases; and this brings us back to one of the principles which we established in our first evening's conversation—that, "if two persons have the *same* understanding of a passage, both ought to read it in the same manner."

Crito. But I do not see that this principle furnishes any reason for a de-

parture from the Rule, that an *indirect* question requires the *falling* inflection. Are not the examples which I gave indirect questions?

Bernardo. They are, assuredly; but they can scarcely be said to be *complete* questions any more than the other examples which puzzled you. Let me change the form a little, and complete the question in each case, and I think you will admit that each still takes the falling inflection at the close, even if you think it does not now.

How shall they call on him if they have not *believed* what is said concerning him? and how shall they believe in him if they have not *heard* of him? and how shall they hear without a *preacher* be sent to them? and how shall they preach except they be *sent* for that purpose?

Crito. The words "believe," "heard," "preacher," and "sent," which ended the several questions in the first form of expression, *you* have made *emphatic*.¹

Bernardo. They were also made *emphatic* before; and that is the principal reason why the divine, whom you heard read them, struck them on so high a key as to give them the *appearance* of taking the rising inflection. He supposed that the Apostle Paul, in these remarks, wished to give the greatest force and prominence to the ideas embraced in these particular words; and as these words were contained in the class of indirect questions, which naturally end with the falling inflection, it was only by striking them on a very high key that the object could be accomplished. Having in mind this view of the apostle's meaning, nature directed him how to express it. Another divine, not taking the same view of the passage, would read these questions, as I have usually heard them read, with the falling inflection very apparent. You will please remember that the Third Rule says, "Indirect questions *generally* require the falling inflection."

Crito. And, as you have explained the examples which I produced, I see that even *they*, the strongest cases which I could find, can scarcely be called exceptions to the Rule.

Bernardo. And, what is of still greater interest and importance, these examples are additional testimony in confirmation of the principle that, when different readings are given to a passage, and both are considered correct, they always arise from somewhat different views in the minds of the readers. Are there any other points which you would like to take up at this time?

Crito. Since our last conversation I have found several cases in which the rising inflection is found at the close of a sentence not a question, and I find nothing by which to explain this apparent opposition to Rule Fourth. I will read the examples:

1. Then said Agrippa unto Festus, This man might have been set at liberty if he had not appealed unto Cæsar.

2. Ingratitude is, therefore, a species of injustice, said Socrates. I should think so, answered Leander.

3. Whence arises the misery of this present world? It is not owing to our cloudy atmosphere, our changing seasons, our inclement skies. It is not owing to the debility of our bodies, or to the unequal distribution of the gifts of fortune. It is owing to our corrupt hearts, our sinful natures.

4. If we have no regard for religion in *youth*, we ought to have some regard for it in *age*.

5. If we have no regard for our *own* character, we ought to have some regard for the character of *others*.

¹ Here the rising slide is given to the closing word, in accordance with the Note to Rule IV. So, also, if Crito had said, "You have made *emphatic*"; but I did not." Probably the true principle which controls the inflection here is that embraced in Rule IX.

Bernardo. For a solution of these difficulties, I must refer you, in the first place, to what is said of the *pause of suspension* under Rule Second.

Crito. I confess that I am still in the dark, as I do not see wherein this rule applies to the examples which I have given.

Bernardo. Perhaps it would have been well if the following had been inserted as a Note explanatory of Rule Second: *Sentences which are inverted in form, often bring the pause of suspension, and consequently the rising inflection, at the close, thus forming an apparent, but not real, exception to the rule.* Now let us change some of these examples back to their more simple forms:

1. Then said Agrippa unto Festus, If this man had not appealed unto Cæsar' he might have been set at liberty'.

2. Ingratitude is therefore a species of injustice', said Socrates. Leander answered', I should think so'.

3. Whence arises the misery of this present world'? It is not owing to our cloudy atmosphere', our changing seasons', our inclement skies'; but it is owing to our corrupt hearts', our sinful natures'.

Although the last two examples which you gave may also be changed so as to bring the falling inflection at the close, yet, without this, they may be explained as having much the character of sentences of gentle appeal, reproof, or expostulation, which take the rising inflection in accordance with Rule IX., and with what is said of both negative and affirmative sentences under the Note to Rule VI. I will give you one or two examples, quite similar to those mentioned by you, but in which the tone of "gentle entreaty or expostulation" is a little more apparent:

6. But he answered and said, It is not meet to take the children's bread, and to cast it to dogs'. 7. But she said, Truth', Lord': yet the *dogs*' eat of the crumbs which fall from their *master's* table'.—Matt., xv., 26-27.

If you will examine closely you will find that several of the examples given, especially those numbered 1, 3, 4, 5, 6, and 7, are examples in which *negation* is opposed to *affirmation*; and you must bear in mind that, although the speaker may not *express* the affirmative part of the sentence, yet, if he has it in his mind, he will give to the negative part the rising inflection, in accordance with Rule VI. Thus, if I speak the negative sentence, "I did not say he was a good citizen'," and give it the rising inflection, I thereby show that I have also an affirmative declaration in my mind.

Crito. I must confess that the difficulties which troubled me have been more easily removed than I anticipated. I am beginning to think there is more science and true philosophy in the art of reading than is usually conceded.

Bernardo. You will find this philosophy more and more apparent the farther you proceed. The inflections which we give to speech depend *wholly* upon the sentiments which we wish to express. Being designed as the exponents of thought, they are not arbitrary or optional, but have their basis in the *nature* of speech itself. *Words* are but *arbitrary* signs of thought; but *inflections*, especially where they are at all marked, are *natural* signs, and are therefore *the same in all languages*. But I have not time to dwell upon this subject here, although it is one that has been wonderfully overlooked by our best elocutionists. In our next conversation I trust we shall be able to enter upon an examination of principles that are somewhat in advance of the Elementary Rules that we have thus far been considering.

FOURTH EVENING.

ANALYSIS.—The “Elements of Elocution” treat chiefly of the pronunciation of *words* rather than of sentences. The various modulations of the voice that are required for whole sentences. *Principles* rather than *rules* are required to guide us. How we naturally express a contrast. “Discretion and cunning,” an example from Addison. Where the speaker puts a question, and then answers it himself. Example from Cicero. Questions that take a declarative form. Emphatic *repetition* of a word or thought. Examples. The introduction of a simile or comparison in poetry. Addison’s description of Marlborough. The principle that governs the reading of a simile. A simile from Milton. The reading of sublime, grand, and magnificent descriptions. Extract from Pope.

Crito. I have been reflecting that thus far, in our conversations, we have been considering chiefly the pronunciation of separate words and syllables, and that the twelve *Rules* which are given in the “Elements of Elocution” treat almost wholly of *words*, separately considered, rather than of *sentences* and entire discourses. Are there no principles of Elocution which apply especially to the different *forms* of expression, and different *kinds* of writing?

Bernardo. There are, most assuredly; and your question very appropriately calls up the very subject to which I alluded at the close of our last conversation. Different modulations of the voice, separate from the inflections, accent, and emphasis that are given to single words, are required to express different sentiments, emotions, and passions. Thus, in reading, sometimes a *high pitch* of voice, and sometimes a *low pitch* is required for whole sentences; and, according to the sentiment and the circumstances of the occasion, the voice must have all varieties of tone or expression, and range through all degrees of high and low, loud and soft, forcible and feeble, quick, moderate, and slow, just as we hear it in natural and free conversation.

Crito. But so many rules are here required to be known that it would seem impossible to learn all the rules for correct reading that might be given.

Bernardo. It is not so much particular *rules* as correct general *principles* that we require to guide us. Moreover, we are already acquainted with these general principles, for we make use of them daily in our ordinary conversation; and what we especially need is to notice *how* we naturally express our own sentiments, and then to apply the principle when we *read* the similar sentiments of others. Thus—for a simple illustration—in briefly describing two persons or objects by contrast or *contraries* (a figure of speech called *antithesis*), we naturally express the first clause of the contrast in a little higher tone of voice than we apply to the latter, with a prolonged pause between them, as in one of the examples under Rule VI.: “Homer—was the greater genius—Virgil—the better artist.” You will also observe that “rhetorical pause of suspension” after the words *Homer* and *Virgil*, to which we have before alluded.

Crito. It occurs to me that a fine example for the exemplification of this principle is furnished by Addison, in a number of the Spectator, in the contrast which is drawn between Discretion and Cunning. It is very evident that throughout this extract the word *cunning* is to be pronounced on a lower pitch than *discretion*, and that it receives the falling inflection on its first syllable, while it has a *very slight* rising inflection at its close. It is an extract worthy of being remembered, also, for the moral which it conveys.

DISCRETION AND CUNNING.

At the same time that I think discretion' the most useful talent that a man can be master of', I look upon cunning to be the accomplishment of little, mean, ungenerous minds. Discretion' points out the noblest ends to us, and pursues the most proper and laudable methods of obtaining them: cunning' has only private selfish aims, and sticks at nothing that may make them succeed. Discretion' has large and extended views', and, like a well-formed eye, commands a whole horizon: cunning' is a kind of short-sightedness', that discovers the minutest objects that are near at hand, but is not able to discern things at a distance.

Discretion', the more it is discovered, gives a greater authority to the person who possesses it: cunning', when it is once detected, loses its force, and makes a man incapable of bringing about even those events which he might have done if he had passed only for a plain man. Discretion' is the perfection of reason', and a guide to us in all the duties of life: cunning' is a kind of instinct', that only looks out after our immediate interest and welfare. Discretion' is only found in men of strong sense and good understanding: cunning' is often to be met with in brutes themselves, and in persons who are but the fewest removes from them: in short', cunning' is only the mimic of discretion, and may pass upon weak men, in the same manner that vivacity is often mistaken for wit', and gravity for wisdom.

Bernardo. The extract which you have given furnishes a fine illustration of the principle referred to, and some good examples of the rhetorical pause of suspension. A similar style of reading is required for passages in which the speaker puts a question, and then answers it himself. If you should ever hear a speaker asking questions, and then answering them himself, if you will notice, I think you will observe that he pronounces the question in a higher, a more open, and declarative tone; and the answer (after a long pause) in a lower, slower, and yet firmer and more emphatic one. Cicero, in his oration for Muræna, makes use of this figure when he says,

Join issue with me upon the crimes themselves. What is your charge, Cato? What is to be tried? What do you offer evidence of? Do you impeach corruption?—*I do not defend it.* Do you blame me for defending, by my pleading, what I punished by law?—*I answer, that I punished corruption, and not innocence:* as to corruption, if you please, I will go hand in hand with yourself in impeaching it.

Sometimes the question takes the declarative form, as in the following extract from Cicero's second oration against Antony. It is not difficult to see that, in the following passage, the answers are to be pronounced in a lower, louder, and more energetic tone than the question part, but with increasing force, to the last Antony.

As trees and plants necessarily arise from seeds, so are you, Antony, the seed of this most calamitous war. You mourn, O Romans! that three of your armies have been slaughtered; *they were slaughtered by Antony:* you lament the loss of your most illustrious citizens; *they were torn from you by Antony:* the authority of this order is deeply wounded; *it is wounded by Antony:* in short, all the calamities we have ever since beheld (and what calamities have we not beheld?), if we reason rightly, have been entirely owing to Antony. As Helen was of Troy, so the bane, the misery, the destruction of this state is Antony.

Crito. As one figure of speech is very apt to suggest another, I am here reminded that the repetition of a word or thought is always pronounced somewhat emphatically; and, when it takes the pause of suspension after it, it usually has the rising inflection also.¹ Thus:

Sir, I should be much surprised to hear that motion opposed by any member in this house. A motion founded in justice', supported by precedent', and warranted by necessity'.

Bernardo. I will add to your illustration by quoting a passage from Cic-

¹ It is laid down by Dr. Porter as a rule, that "Emphatic repetition requires the falling slide." He gives as example:

"You wrong me every way, you *wrong*' me Brutus."

I regard this, however, merely as a case of ordinary emphasis, having the usual falling inflection. Certainly the examples of repetition given above do not take the falling inflection.

ero's oration against Antony, in which the word *laws* receives increasing force upon every repetition, which gives it a climax of importance :

And shall we think of ratifying the *acts* of Caesar, yet abolish his *laws*? Those laws which he himself, in our sight, repeated, pronounced, enacted? *Laws* which he valued himself upon passing? *LAWs* in which he thought the system of our government was comprehended? *LAWs* which concern our provinces and our trials? Are we, I say, to repeal such laws, yet ratify his acts? Yet may we at least complain of those which are only proposed : as to those which we pass, we are deprived even of the liberty to complain.

Crito. Again the principle of suggestion comes in to furnish me with a parallel passage. It is that in which Germanicus, addressing his mutinous soldiers, employs questions to give force and spirit to his reproaches. The repetition of the pronoun *you*, with the circumflex, forms a climax of great beauty.

What is there in these days that you have not attempted? What have you not profaned? What name shall I give to this assembly? Shall I call you soldiers? *You* who have besieged with your arms, and surrounded with a trench, the son of your emperor? Shall I call you citizens? *You* who have so shamefully trampled upon the authority of the senate? *You* who have violated the justice due to enemies, the sanctity of embassy, and the rights of nations?

Bernardo. As I remarked at the beginning of this conversation, that sometimes a high pitch of voice is required, and sometimes a low one, according to the sentiment, it may be well to notice, in this place, the change of voice with which we should introduce an illustrative *simile* or *comparison* in poetry. I think it will be found that at least the *beginning* of the simile should be read in a lower and more plaintive tone of voice than that part of the passage which precedes it. But let us take an example or two. Suppose we begin with Addison's beautiful description of Marlborough in battle.

	'Twas then great Marlborough's mighty soul was proved, That in the shock of charging hosts unmoved, Amid confusion, horror, and despair, Examined all the dreadful scenes of war ; In peaceful thought the field of death survey'd, To fainting squadrons sent the timely aid ; Inspired repulsed battalions to engage, And taught the doubtful battle where to rage.
Simile.	{ So when an angel, by divine command, With rising tempests shakes a guilty land, (Such as of late o'er pale Britannia past), Calm and serene he drives the furious blast ; And, pleased the Almighty's orders to perform, Rides on the whirlwind, and directs the storm.—ADDISON.

You perceive how much the reading of this piece is embellished by allowing the voice to drop into a monotone at the commencement of the simile, and then gradually slide out of it, and rise to a higher pitch to avoid too great a sameness.

Crito. And I think that I perceive a peculiar propriety in this mode of introducing a simile in poetry. It must be based upon this principle, that the mind, in forming a simile, is seldom agitated by any strong passion; and as the simile is something that is thrown in to explain or illustrate, that tone of voice which expresses serene, tranquil contemplation, seems to be the tone most suitable to it; and this, if I am not mistaken, will be found to be the plaintive tone, approaching to a monotone. Milton's beautiful description of the sports of the fallen angels affords a good opportunity of exemplifying the rule :

Part curb their fiery steeds, or shun the goal
With rapid wheels, or fronted brigades form, —

simile. { As when, to warn proud cities, war appears
 Waged in the troubled sky, and armies rush
 To battle in the clouds, before each van
 Prick forth the airy knights;—with feats of arms
 From either end of heaven the welkin burns.
 Others with vast Typhoean rage more fell,
 Rend up both rocks and hills, and ride the air
 In whirlwind; hell scarce holds the wild uproar.
 simile. { As when Alcides, from Cechalia crown'd
 With conquest, felt th' envenom'd robe; and tore,
 Through pain, up by the roots Thessalian pines,
 And Lichas from the top of Ceta threw
 Into th' Euboe sea.—MILTON.

Bernardo. Something allied to the principle involved in reading the simile, is that which requires that sublime, grand, and magnificent descriptions in poetry should be read with a similar falling of the voice, and a sameness nearly approaching to monotone. Thus, in the following extract from Pope, a series of grand images, commencing at the fifth line, fills the mind with surprise approaching to astonishment. As this passion has a tendency to fix the body, and deprive it of motion, so it is best expressed, in speaking or reading, by a deep and almost uniform tone of voice,—such inflections as are required being less in degree than in most other cases.

And if each system in gradation roll',
 Alike essential to th' amazing whole',
 The least confusion but in one, not *all*
 That system only', but the *whole* must fall'.
 Let earth unbalanced from her orbit fly,
 Planets and suns run lawless through the sky';
 Let ruling angels from their spheres be hurl'd,
 Being on being wreck'd, and world on world',
 Heaven's whole foundations to their centre nod',
 And Nature tremble to the throne of God':
 All this dread order break'!—for whom? for thee'?
 Vile worm!—oh madness! pride! impiety!—POPE.

But I see our time is already exhausted, and we must defer a farther consideration of the subject until the next evening.

FIFTH EVENING.

ANALYSIS.—Public speaking; and *reading* in public the speeches of others. General principles that should govern both. How should we read a quoted speech in the speech of another? The speech of Cassius, in which he repeats the supplicating words of Cæsar. The principle that should govern the reading of it. Hotspur's description of a conceited fop. The swain in Gray's Elegy. The "Last words of Marston." General principles. The reading of dialogue, where the personification is complete. Gray's poem, "The Bard." The personification of Pride, in Pope's Essay on Man.

Bernardo. Well', Crito', what topic or topics have you to suggest for our consideration this evening'?

Crito. I have been thinking upon the subject of public speaking, and also about *reading* in public the speeches of others.

Bernardo. A very important subject; or, rather, *two* important subjects, as they are not one and the same thing. Do they suggest any difficulties to you'?

Crito. I have seen it laid down as a rule that in *speaking* the speech of another, we should give it all the force and energy that would become the character whose words are assumed. This appears reasonable, because we assume to *personate* another—to put ourselves in his place. But I would like to know if we ought to *read* the speech of another just as we should pronounce it from the rostrum. In other words, if we *read* a speech

merely for the information of our hearers, should we do it *oratorically*?*

Bernardo. I am pleased with your question, for it shows that you have already discriminated between the character of an orator uttering his own sentiments, and that of one who merely reads from a book. Where the reader merely *reads his own* speech, he may safely act the orator in his own person; but if he merely assumes the character of a reader of the words of another, he occupies a different position in the view of his hearers, and his manner must be different. Yet I would have you bear in mind that these two kinds of style or manner of reading should differ only in degree of force; the greater degree in the case of the orator, and the lesser in that of the reader: the tones, inflections, and gesticulations should be the same *in kind* in both.

Crito. I see there is much reason in this rule; for it would be very difficult for one who had assumed the character of a reader to change wholly to that of an orator, without doing violence to the feelings of his hearers. And yet the reader must give tones and inflections of the same *kind* as the orator used, or he will not faithfully represent him. But still another point has been suggested to me. What if the speaker quotes what *another* person said: how should we *read* this speech within a speech? For example, we will take the speech of Cassius, in which he is describing Cæsar under the paroxysms of a fever. Cassius says,

He had a fever when he was in Spain,
And, when the fit was on him', I did mark
How he did shake': 'tis' true', this god' did shake',
His coward lips did from their color fly',
And that same eye', whose bend doth awe the world',
Did lose his lustre': I did hear him groan',
Ay, and that tongue of his', that bade the Romans
Mark him', and write his speeches in their books',
Alas! it cried', "Give me some drink', Titinius',"
As a sick' girl.—SHAKESPEARE.

Must these words of Cæsar, "Give me some drink', Titinius',"† be pronounced in exact *imitation* of the small, feeble voice of a sick person—just as Cæsar spoke them?

Bernardo. By no means, because Cassius did not pronounce them so; for, with only a partial imitation of the feeble voice of Cæsar, Cassius united a tone of scorn and contempt, which we should preserve when reading the passage. You must bear in mind that when reading a speech you are to assume the character of the *leading speaker* throughout, modified only in degree. If Cassius (the leading speaker) had merely *mimicked* Cæsar, without uniting scorn and contempt with the mimicry, he would have lowered himself to the character of a buffoon, and would thus have made himself appear ridiculous. Much *more* ridiculous should we appear if, in reading this passage, we should become the *mere* mimic, and that at *third* hand too.

In Shakspeare's Henry the Fourth, the hero, Hotspur, describes a conceited fop in language indicative of anger and contempt. In reading the speech we must assume the character of Hotspur rather than that of the

* If the reader supposes that Crito designed this as a *repeated* question, he will give it the falling inflection, in accordance with Note 3, Rule I. Otherwise he will give it the rising inflection. Now who shall decide what Crito's intention was? All those who regard it as a *repeated* question will evidently read it in one way, and all those who regard it as merely *explanatory* will read another way. This well illustrates the principle laid down, that *different readings* of a passage arise from *different interpretations* of it.

† Even here the degree of force must be *less* than when these words are supposed to be spoken by Cassius.

fop whom he describes, carrying out the leading passion instead of the secondary. If in reading any piece we so far forget the leading passion as to assume the secondary entirely, we fall into mimicry, and render our expression, however just in other respects, ridiculous. I will read the whole speech of Hotspur, in one part of which, as you will perceive, he assumes to give the language of the fop.

My liege, I did deny no prisoner.
 But I remember, when the fight was done,
 When I was dry with rage and extreme toil,
 Breathless and faint, leaning upon my sword,
 Came there a certain lord, neat, trimly dress'd,
 Fresh as a bridegroom; and his chin, new reap'd,
 Show'd like a stubble-field at harvest-home:
 He was perfum'd like a milliner;
 And 'twixt his finger and his thumb he held
 A pouncet-box, which ever and anon
 He gave his nose, and took't away again;
 Who, therewith angry, when it next came there,
 Took it in snuff: and still he smiled and talk'd;
 And as the soldiers bore dead bodies by,
 He called them untaught knaves, unmannerly,
 To bring a slovenly unhandsome corse
 Betwixt the wind and his nobility.
 With many a holiday and lady terms
 He question'd me; among the rest demanded
 My prisoners, in your majesty's behalf.
 I then, all smarting, with my wounds being cold,
 To be so pester'd by a popinjay,
 Out of my grief and my impatience,
 Answer'd neglectingly, I know not what;
 He should, or he should not; for he made me *mad*,
 To see him shine so brisk, and smell so sweet,
 And talk so like a waiting gentlewoman,
 Of guns, and drums, and wounds (God save the mark!),
 And telling me the sovereign'st thing on earth
 Was spermaceti for an inward bruise;
 And that it was great pity, so it was,
 That villainous saltpetre should be digg'd
 Out of the bowels of the harmless earth,
 Which many a good tall fellow had destroyed
 So cowardly; and, but for these vile guns,
 He would himself have been a soldier.
 This bold unjointed chat of his, my lord,
 I answer'd indirectly, as I said;
 And I beseech you, let not this report
 Come current for an accusation,
 Betwixt my love and your high majesty.—SHAKESPEARE.

Crito. I perceive that the rule which you have laid down will also apply to what is supposed to have been said by the hoary-headed swain in Gray's *Elegy in a Country Church-yard*.

For thee, who, mindful of the unhonor'd dead,
 Dost in these lines their artless tale relate,
 If chance, by lonely Contemplation led,
 Some kindred spirit should inquire *thy fate*,
 Haply some hoary-headed swain may say,
 "Oft have we seen him, at the peep of dawn,
 Brushing with hasty steps the dews away,
 To meet the sun upon the upland lawn.
 "There, at the foot of yonder nodding beech,
 That wreathes its old fantastic roots so high,
 His listless length at noontide would he stretch,
 And pore upon the brook that babbles by," etc.—GRAY.

Bernardo. You are correct. It would be very ridiculous, in reading this

passage, to quit the melancholy tone of the narrator, and assume the indifferent and rustic accent of the old swain. What is needed in reading the last seven lines of this extract is to abate the plaintive tone a little, and give it a slight tincture only of the indifference and rusticity of the person introduced.

The same principle applies to the "last words of Marmion," in the following extract from Sir Walter Scott:

The war, that for a space did fail,
Now trebly thundering swelled the gale,
And—Stanley! was the cry.
A light on Marmion's visage spread,
And fired his glazing eye.
With dying hand, above his head
He shook the fragment of his blade,
And shouted "Victory!
Charge, Chester, charge! On, Stanley, on!"
Were the last words of Marmion.—SCOTT.

How often have I heard this passage, containing the last words of the dying hero, murdered by the schoolboy in a vain attempt to give it *all* the force of the living reality. Where the narrator stands out prominently before the mind, and is represented as *telling what another person said*, it is not in good taste for one who is reading the narration to change to, and fully assume, the character of that other person. He must give the greater prominence throughout to the passion shown by the leading character—that of the supposed narrator. For example, the reader or speaker should give greater prominence to the passion of Cassius' than to that of sick Cæsar'; to that of Hotspur' than to that of the fop'; to that of the narrator in the *Elegy*' than to that of the rustic swain'; and to that of the describer of the battle' than to the character of Marmion'. Much force should, indeed, be given to the repeated words of Marmion, but they must not be *screamed* out, as Marmion uttered them.

Crito. But what if I am reading a dialogue, or one of Shakspeare's Plays. Do the same principles prevail here', and is the same rule to be observed'?

Bernardo. By no means. The principles of the composition are entirely different. In dialogue, the personification of each character is complete and entire in itself, and wholly independent. Therefore, in dialogue, or in dramatic composition, full force and energy should be given to the passion shown by each character.

Crito. May not, then, the personification be so complete in some other kinds of composition as to require the same degree of force and energy as in dramatic writing'?

Bernardo. Certainly it may be. Thus, at the beginning of Gray's Poem, "The Bard," one of the bards of Wales is represented as meeting King Edward on his march, and addressing him in the following language of sublime rage, which should be read or spoken with all the vehemence which may be supposed to have characterized the language of the bard himself.

"Ruin seize thee, ruthless king!
Confusion on thy banners wait!
Though fann'd by conquest's crimson wing,
They mock the air with idle state.
Helm, or hauberk's twisted mail,
Nor e'en thy virtues, tyrant, shall avail
To save thy secret soul from nightly fears,
From Cambria's curse, from Cambria's tears!"
Such were the sounds that o'er the crested pride
Of the first Edward scatter'd wild dismay,

As down the steep of Snowdon's shaggy side
He wound with toilsome march his long array.—GRAY.

Here the personification is complete, and the language of the bard is strictly dramatic. I will give you one example more. The personification of pride, in Pope's Essay on Man, is complete, and not subordinate to any other passion, and may therefore be allowed a forcible dramatic expression.

Ask for what end the heavenly bodies shine',
Earth for whose use: 'Pride' answers', "'Tis for mine'.
For *me* kind Nature wakes her genial power,
Suckles each herb, and spreads out every flower;
Annual for me the grape, the rose, renew
The juice nectareous, and the balmy dew':
For *me* the mine a thousand treasures brings',
For *me* health gushes from a thousand springs';
Seas roll to waft me', suns to light me rise',
My footstool earth', my canopy the skies'."—POPE.

This passage is essentially dramatic, and admits of a certain splendor in the pronunciation expressive of the ostentation of the speaker, and the riches and grandeur of the objects introduced. But I think we have gone over sufficient ground for one evening. The topics which we have here only briefly adverted to may be considered as merely introductory to the subject of ORATORY, which I trust you will have opportunity to attend to hereafter.*

SIXTH EVENING.

ANALYSIS.—Directions for the cultivation of the voice. Flexibility. Power of voice. The natural pitch of the voice. The middle tone. Practical directions for strengthening this middle tone. Macbeth's address to Banquo's ghost. Exercises for strengthening the low or bass tones. Lady Macbeth's reproach of her husband. Lady Constance reproaching the Duke of Austria. Exercises for strengthening the high tones. Cautions suggested. Extract from an oration of Demosthenes. The harmonizing of the *sense* and the *sound*. To preserve the melody of verse and avoid monotony. Lamentation of Orpheus. Darius. Repetition of a word. When a sing-song tone may be admissible. "The Pauper's Drive." Extensive use of the circumflex or wave. Use of the tremor.

Crito. In our former conversations it appears to have been taken for granted that the reader is able to execute readily all those inflections and modulations of voice that are required in the various kinds of elocutionary reading. But may not some useful directions be given for the cultivation of the voice'?

Bernardo. The cultivation of clearness and distinctness of intonation, together with practice in the inflections and modulations, will give the voice all requisite *flexibility*; but something more is required to give it *power*. That requires a different kind of practice—a physical training of the voice, which should be under the guidance of physiological principles.

Crito. But may not judicious exercises be appropriately given for strengthening the voice, even without a knowledge of the principles to which you refer'?

Bernardo. There may, indeed, and to some of them I purpose now to call your attention. You are perhaps aware that every one has a certain natural pitch of voice, in which he is most easy to himself, and most agreeable to others. This is the pitch in which we converse; and this must be the basis of every improvement we acquire from art and exercise. If we would increase our *power* of voice, we must strengthen this ordinary middle tone; and in order to do this, we must read and speak in this tone as loud as possible, without suffering the voice to rise into a higher key.

* The subject of ORATORY is set apart as one of the divisions of the Seventh, or Academic Reader.

When we attempt this for the first time we find it no easy operation ; it is not difficult to be loud in a high tone, but to be loud and forcible without raising the voice into a higher key requires great practice and management. If you wish to strengthen your voice without danger of injuring it by over-exertion, I would advise you to practice reading and speaking some strong, animated passages in a small room, and to persons placed at as small a distance from you as possible ; address them with your voice at a natural pitch, and throw into it all the force possible, taking care not to let the voice rise into a higher key. This will tend to swell and strengthen the voice in the middle tone, the tone that is most required in reading and oratory, and the only tone that one can speak in for a long time with comfort to himself or pleasure to others. A good practice on this tone of voice will be such passages as Macbeth's address to Banquo's ghost, or any other language addressed to persons near us.

Avant! and quit my sight! let the earth hide thee!
Thy bones are marrowless, thy blood is cold;
Thou hast no speculation in those eyes
Which thou dost glare with!

What man dare I dare:

Approach thou like the rugged Russian bear,
The arm'd rhinoceros, or the Hyrcan tiger;
Take any shape but *that*, and my firm nerves
Shall never tremble.

Hence, horrible shadow!

Unreal mock'ry, hence!—*Macbeth*, Act III., Scene 4.

Crito. Such exercises, I perceive, are well fitted to strengthen the ordinary tone ; but if one is deficient in the low or *bass* tones (which I know are sometimes very effective in oratory), what kind of pieces will then be most suitable for practice ?

Bernardo. Those, doubtless, which indicate hatred, scorn, or reproach ; for such feelings are naturally expressed in a full, audible tone of voice, and in a low key. Such pieces should be read or spoken at first a little below the common pitch ; when we can do this with ease we may practice them on a key a little lower, and then lower still, and so on until we get as low as we desire. The following, from Shakspeare, where Lady Macbeth reproaches her husband with want of manliness, will be found a good exercise for this purpose :

O proper stuff!

This is the proper painting of your fears:
This is the air-drawn dagger, which you said
Led you to Duncan. Oh, these flaws and starts
(Impostors to true fear) would well become
A woman's story at a winter's fire,
Authorized by her *grandam*. Shame itself!
Why do you make such faces? When all's done,
You look but on a stool.—*Macbeth*, Act III., Scene 2.

Or where Lady Constance, in King John, reproaches the Duke of Austria with want of courage and spirit:

Austria. Lady Constance, peace!
Constance. War! war! no peace! peace is to me a war.

O Austria! thou dost shame
That bloody spoil. Thou slave! thou wretch! thou coward!
Thou little valiant, great in villainy!
Thou ever strong upon the stronger side!
Thou fortune's champion, that dost never fight
But when her humorous ladyship is by
To teach thee safety! thou art *perjur'd* too,
And sooth'st up greatness. What a fool art thou!
A ramping fool; to brag, and stamp, and swear!

- Upon my party! Thou cold-blooded slave,
 Hast thou not spoke like thunder on my side?
 Been sworn my soldier? bidding me depend
 Upon *thy* stars, *thy* fortune, and *thy* strength?
 a. And dost thou now fall over to my foes?
 b. *Thou* wear a *lion's* hide! Doff it for shame,
 c. And hang a calf's skin on those recreant limbs.

King John, Act III., Scene 1.

Crito. And I suppose that for acquiring strength in a high tone of voice, the very opposite class of pieces should be practiced upon—those which naturally require a high tone.

Bernardo. Certainly. But here one or two cautions are requisite. Care must be taken not to strain the voice by over-exertion; and, in the second place, when the entire-piece read or spoken requires a high pitch, we must avoid the evil of a loud and vociferous beginning. Thus, in the following passage from an oration of Demosthenes, the series of questions ought to rise gradually in *force* as they proceed, although the *pitch* should be the same throughout the series. In the closing sentence, however, the voice should fall to a slow but forcible monotone.

What was the part of a faithful citizen? of a prudent, an active, and honest minister? Was he not to secure Eubœa, as our defense against all attacks by sea? Was he not to make Bœotia our barrier on the midland side? the cities bordering on Peloponnesus our bulwark on that quarter? Was he not to attend with due precaution to the importation of corn, that this trade might be protected through all its progress up to our own harbor? Was he not to cover those districts which we commanded by reasonable detachments? to exert himself in the assembly for this purpose, while with equal zeal he labored to gain others to our interest and alliance? Was he not to cut off the best and most important resources of our enemies, and to supply those in which our country was defective?—And all this you gained by my counsels and my administration.

Crito. It has occurred to me that, as all possible varieties of emotions and feelings may be expressed in verse, and as the reading of verse requires the observance of certain pauses of melody, the *sense* and the *sound* may sometimes fail to harmonize.

Bernardo. That ought seldom to happen; for as a coincidence in the pauses of sense and melody is a capital beauty, a good poet will always strive to attain it. In reading verse, the pronunciation should conform as nearly to the melody as the sense will admit, care being taken to break the monotony by a judicious use of the inflections. You will observe that, in reading the following selections, I preserve the melody of the verse, while the monotony is broken by a judicious varying of the inflections. The first example, which is from Virgil, is the plaintive lamentation of Orpheus for his beloved Eurydice:

Thee', his lov'd wife', along the lonely shores;
 Thee', his lov'd wife', his mournful song deplores;
 Thee', when the rising morning gives the light;
 Thee', when the world was overspread with night.—VIRGIL.

The next is from Dryden, who thus paints the sad reverse of fortune suffered by Darius:

Deserted at his greatest need
 By those his former bounty fed,
 He chose a mournful muse,
 Soft pity to infuse:
 He sung Darius', great and good',
 By too severe a fate,
 Fallen', fallen', fallen', fallen',

- a. These questions gradually increase in elevation of tone and intensity.
 b. Here the voice suddenly falls, and takes a tone of the most bitter irony.
 c. Spoken with the bitterest scorn.

Fallen' from his high estate,
And weltering in his blood.—DRYDEN.

I will give one more example, in which, also, there is a *repetition* of a word—a figure of speech which is sometimes used to mark the importance of some emphatical word or phrase.

Happy', happy, 'happy' pair' !
None but the *brave* !
None' but the brave,
None *but* the brave, deserve the fair.

Crito. I observe in these examples that a sing-song monotony and tameness of expression are avoided by a judicious use of emphasis and inflections. But may not, sometimes, a sing-song tone be *required*, in order to express the sentiments or the feelings of the writer' ?

Bernardo. I am very glad you have asked the question, for it recalls to my mind an English ballad of great power and beauty, in one portion of which this very sing-song tone of reading is required, to harmonize with the sense and the scene represented. It is the "Pauper's Drive," written by Thomas Noel. As we read the dirge which the driver sings, we can scarcely refrain from singing it too, and with a kind of careless sadness, which, in the closing of the fourth verse, changes to a plaintive and impressive reproof.*

THE PAUPER'S DRIVE.

There's a grim one-horse hearse, in a jolly round trot ;
To the church-yard a pauper is going, I wot ;
The road it is rough, and the hearse has no springs,
And hark to the dirge which the sad driver sings :

Rattle his bones over the stones ;
He's only a pauper whom nobody owns.

Oh where are the mourners' ? alas ! there are none ;
He has left not a gap in the world now he's gone ;
Not a tear in the eye of child, woman, or man :
To the grave with his carcass as fast as you can.

Rattle his bones over the stones ;
He's only a pauper whom nobody owns.

What a jolting, and creaking, and splashing, and din !
The whip how it cracks, and the wheels how they spin !
How the dirt right and left o'er the hedges is hurled !
The pauper at length makes a noise in the world !

Rattle his bones over the stones ;
He's only a pauper whom nobody owns.

Poor pauper defunct ! he has made some approach
To gentility', now that he's stretched in a coach' ;
He's taking a drive in his carriage at last,
But it will not be long if he goes on so fast :

Rattle his bones over the stones ;
He's only a pauper whom nobody owns.

But a truce to this strain', for my soul it is sad, —
To think that a heart, in humanity clad, —
Should make, — like the brutes, — such a desolate end',
And depart from the light without leaving a friend.

Bear softly his bones over the stones :
Though a pauper, he's one whom his *Mäker* yet owns.

THOMAS NOEL.

Crito. The reading of this last line leads me to ask if the intonation denoted by the circumflex or wave is not frequently employed to express tender and pathetic feelings ?

Bernardo. It is ; and the "gentle rising inflection" which is mentioned in Rule IX. as the proper intonation for *tender* emotion is in reality the

circumflex that terminates with the rising slide. Thus, in the example there given—"Is your *father* well', the *old man*' of whom ye spake'? Is *he*' yet *alive*'?"—the rising inflection, as marked, is really the ending of the circumflex. This kind of circumflex, it may be remarked, is the proper intonation of prayer, and of all serious appeal, and even of narrative into which tender emotion enters. Thus, if the following, which has no emphatic words, be read with tender feeling, *every syllable* will have a gentle circumflex or wave, ending with the upward slide:

"Beneath those rugged elms, that yew-tree's shade,
Where heaves the turf in many a mouldering heap,
Each in his narrow cell forever laid,
The rude forefathers of the hamlet sleep."—GRAY.

In the following example, however, it is only the emphatic words which receive the circumflex, which is a little more conspicuous here than when it is given to every syllable.

"And is this *all* your store'? and a *share* of *this* do you offer to *one* you *know* not'? Then never saw I *charity* before'."

I have one more remark to make on this subject of expression. You have doubtless noticed that in very effective reading or speaking, into which emotion enters, a kind of *tremor* of the voice may often be observed. It is not confined to any one kind of emotion, but, when skillfully used, gives additional force to expressions of joy, rapture, triumph, scorn, and contempt, and also to those of great grief and anguish. Its two extremes tend toward laughter on the one hand, and crying on the other. We have an example of the former from Shakspeare, in Shylock's exultation at the decision of the learned judge, seemingly in his favor:

"A Daniel come to judgment! I yea, a Daniel!
O wise young judge', how I do honor' thee!"

but still better in Gratiano's exultation at the discomfiture of the Jew:

"O upright judge!—mark Jew;—O learned judge!"

and of the latter we have a good example in Shylock's grief, which shows itself in the tremulous tones of a broken-hearted old man:

"I pray you give me leave to go from hence:
I am not well; send the deed after me,
And I will sign it."

It is impossible, however, to appreciate the spirit of these extracts, and read them appropriately, without a knowledge of the whole play. The following, which almost every one would naturally read in a monotone, and with a slight tremor, will be better appreciated:

"The tear,
The groan, the knell, the pall, the bier,
And all we know, or dream, or fear
Of agony, are thine."—HALLER.

That old but truly beautiful piece, "The Beggar's Petition," loses all its pathos if not read with the tremor which we should expect from one whose condition is there represented. I will pronounce the first verse only:

"Pity the sorrows of a poor old man,
Whose trembling limbs have borne him to your door,
Whose days are dwindled to the shortest span;
Oh! give relief, and Heaven will bless your store."

It requires an accomplished rhetorician to read such pieces well.

ADDITIONAL ELOCUTIONARY EXERCISES,

WITH REFERENCES TO THE RULES.

[The figures refer to the rules indicated by them.]

Can *he* exalt his thoughts to any thing great and noble who only believes that, after a short turn on the stage of this world, he is to sink into oblivion, and to lose his consciousness forever? ¹

How can *he* exalt his thoughts to any thing great and noble who only believes that, after a short turn on the stage of this world, he is to sink into oblivion, and to lose his consciousness forever? ²

b. Where amid the dark clouds of pagan philosophy, can he show us so clear a prospect of a future state¹, the immortality of the soul¹, the resurrection of the dead¹, and the general judgment¹,³ as in St. Paul's First Epistle to the Corinthians¹?

Can he show us, any where, amid the dark clouds of pagan philosophy, so clear a prospect of a future state¹, the immortality of the soul¹, the resurrection of the dead¹, and the general judgment¹, as in St. Paul's First Epistle to the Corinthians¹? (Rule VIII., Note.)

Shall we, in your person, *crown* the author of the public calamities¹, or shall we *destroy* him¹? ²

a. To advise the ignorant¹,³ relieve the needy¹,³ comfort the afflicted¹, are duties that fall in our way almost every day of our lives.

a. The miser is more industrious than the saint. The pains of getting¹,³ the fear of losing¹,³ and the inability of enjoying his wealth¹, have been the mark of satire in all ages.

a. The descriptive part of this allegory is likewise very strong, and full of sublime ideas. The figure of Death¹,³ the regal crown upon his head¹,³ his menace to Satan¹,³ his advancing to the combat¹,³ the outcry at his birth¹, are circumstances too notable to be passed over in silence, and extremely suitable to this king of terrors.—ADDISON'S *description of MILTON'S Figure of Death*.

b. Life consists not of a series of illustrious actions¹ or elegant enjoyments¹; ⁵ the greater part of our time passes in compliance with necessities¹, in the performance of daily duties¹, in the removal of small inconveniences¹, in the procurement of petty pleasures.—JOHNSON.

c. The ill-natured man, though but of equal parts with the good-natured man, gives himself a larger field to expatiate¹ in; he exposes those failings in human nature which the other would cast a veil¹ over; laughs at vices which the other either excuses or conceals¹; falls indifferently upon friends or enemies¹; exposes the person who has obliged¹ him; and, in short¹, sticks at nothing that may establish his character of a wit.—*Spectator*, No. 169.

When the proud steed shall know why man restrains¹

His fiery course,¹ or drives him o'er the plains¹; ²

When the dull ox,¹ why now he treads the clod,

Is now a victim,¹ and now Egypt's god¹;

Then shall man's pride and dullness comprehend

d. His actions¹, passions¹, being's¹ use and end¹;

d. Why doing¹, suffering¹, check'd¹, impell'd¹—and why

This hour a slave¹, the next a deity¹.

As no faculty of the mind is capable of more improvement than the memory¹,² so none is in more danger of decay by disuse¹.

Is the goodness¹ or wisdom¹ of the Divine Being more manifest in this his proceedings¹? ²

Is the power¹ or greatness¹ of the Divine Being manifest in this his proceedings¹? (Rule V., Note II.)

Whither shall I turn¹? ² Wretch that I am¹! ³ to what place shall I betake¹ myself? ³ Shall I go to the Capitol¹? ¹ Alas! it is overflowed with my brother's blood¹. Or shall I

a. a. a. These are examples of *commencing* series.

b. This contains an example of a *concluding* series, in which all the particulars, *except the last but one*, have the falling inflection.

c. This contains an example of a *concluding* series, in which *all* the particulars have the falling inflection, because the concluding member has a pause with the rising inflection before the end.

d. d. Examples of the concluding series. Observe in this extract numerous examples of the pause of suspension, in which the voice preserves a monotone.

retire to my house' ^{5a} Yet there I behold my mother plunged in misery, weeping and despairing'.

Virtue is of intrinsic value and good desert, and of indispensable obligation; not the creature of will', but necessary and immutable';⁶ not local or temporary', but of equal extent and antiquity with the divine mind';⁶ not a mode of sensation', but everlasting truth';⁶ not dependent on power', but the guide of all power'. Virtue is the foundation of honor and esteem', and the source of all beauty', order', and happiness' in nature'.

Though gentle', yet not dull':

Strong', without rage'; without o'erflowing', full'.⁶—DENHAM.

But, waiving all other circumstances, let us balance the real situation of the opposing parties; from that we can form a true notion how very low our enemies are reduced. Here, regard to virtue' opposes insensibility to shame';⁶ purity', pollution'; integrity', injustice'; virtue', villainy';⁶ resolution', rage'; dignity', defilement'; regularity', riot'.⁶ On one side are ranged equity', temperance', courage', prudence', and every virtue'; on the other', iniquity', luxury', cowardice', rashness', with every vice'. Lastly', the struggle lies between wealth' and want'; the dignity' and degeneracy' of reason';⁶ the force' and the phrensy' of the soul; between well-grounded hope' and widely-extended despair'. In such a strife',⁸ in such a struggle as this',⁸ even though the zeal of men were wanting', must not the immortal gods give such shining virtues the superiority over so great and such complicated vices'?¹ Certainly'.—CICERO'S *Oration against CATILINE*.

b. Vice is a monster of so frightful mien',

As to be hated' needs but to be seen';

b. Yet seen too oft', familiar with her face',

c. We first endure', then pity', then embrace'.

But where th' *extreme* of vice' was ne'er agreed':

Ask where's the *north*, at Yörk 'tis on the Tweed':

No creature owns it in the *first* degree,

But thinks his neighbor further gone than he.

E'en those who dwell beneath its very zone',

Or never *feel* the rage', or never own':

What happier natives shrink at with affright',

The hard inhabitant contends' is right'.—POPE.

d. Shall burning Etna,—"if a sage requires,"

Forget to thunder,—"and recall her fires'?"

On air or sea new motions be impress'd,

O blameless Bethel,—"to relieve thy breast'?"

When this loose mountain trembles from on high,—"

Shall gravitation cease,—"while you go by'?"

Or some old temple,—"nodding to its fall,"

For Charities' head reserve the hanging wall'?"—POPE.

I knew when seven justices could not make up a quarrel; but when the parties were met themselves, one of them thought but of an if: as if you said *sō*, then I said *sō*; and they shook hands, and were sworn brothers'.—SHAKESPEARE.

This thy vaunt:

"Give death his due', the *wretched*', and the *old*';

"Let him not violate kind *nature's* laws',

"But own man born to *live*' as well as *die*'."

Wretched and old thou *givest* him'; young and gay

He *takes*'; and plunder is a tyrant's joy.

What, Tubero, did that naked sword' of yours mean in the battle of Pharsalia'? At whose breast' was its point aimed'? What was then the meaning of your arms', your spirit', your eyes', your hands', your ardor of soul'? What did you desire', what wish' for? I press the youth too much; he seems disturbed. Let me return to myself. I too bore arms on the same side'.—CICERO.

What is time'?

I asked a spirit lost'! but on the shriek

That pierced my soul'! I shudder while I speak—

a. The application of the Fifth Rule here will be very apparent if the preceding sentence ("Alas!" etc.) be stricken out.

b. b. The word *mien*, being emphatic, must have the falling inflection: so also *oft*.

c. This line well illustrates the beauty of the rule relating to a *concluding series*.

d. The pause of suspension in this extract denotes a sameness of voice, or monotone, wherever it is used.

e. The falling inflection throughout this example is nearly allied to the circumflex.

- a. It cried, "A particle!—a *speck*!—a MITE!
Of endless years', duration infinite!"—MARSDEN.
The cloud-capp'd towers, the gorgeous palaces,
The solemn temples, the great globe itself,
- b. Yea, *all which it inherit*', shall dissolve;
And, like the baseless fabric of a vision,
Leave not a rack behind.—SHAKESPEARE.
- Parting day
- Dies like the dolphin, whom each pang imbues
With a new color, as it gasps away,
- c. The last still loveliest, till—'*tis gone*'—and all is gray.
- d. High on a throne of royal state, which far
Outshone the wealth of Ormus or of Ind;
Or where the gorgeous East, with richest hand,
Show'rs, on her kings barbaric, pearl and gold,
Satan exalted sat.—MILTON.
- O my soul's joy!
- e. If after every tempest come *such* calms',
May the winds blow till they have waken'd death'!
- e. O joy'! thou welcome stranger'! twice three years
I have not felt thy vital beam'; but now
It warms my veins', and plays about my heart':
A fiery instinct lifts me from the ground,—
And I could mount—
- f. I am not mad'—I would to heaven I were'!
For then 'tis like I should *forget* myself':
Oh if I could, what *grief* should I forget!
- g. That strain again'! it had a dying fall'!
Oh, it came o'er my ear like the sweet south,
That breathes upon a bank of violets,
Stealing and giving odor.

The beauty of a plain', the greatness of a mountain', the ornaments of a building', the expression of a picture', the composition of a discourse', the conduct of a third person', the proportion of different quantities and numbers', the various appearances which the great machine of the universe is perpetually exhibiting', the secret wheels and springs which produce them', all the general subjects of science and taste', are what we and our companions regard as having no peculiar relation to either' of us.^h

TO-MORROW.

- To-morrow didst thou say'?
- Methought I heard Horatio say to-morrow';
- i. Go to', I will not hear' of it; to-morrow'!
- 'Tis a sharper, who stakes his penury'
Against thy plenty'; who takes thy ready cash,
And pays thee naught but wishes, hopes, and promises',
The currency of idiots'; injurious bankrupt,
- i. That gulls the easy creditor. To-morrow'!

a. This is an example of intensive emphasis, which rises into a climax at MITE.
b. This also requires a gradually rising pitch of the voice on each successive member to the *acme* of the passage; then, by a gradual descent, the voice should return to its ordinary level.

c. Rhetorical pause of suspension.

d. Rule XII., the monotone.

e. e. Unexpected joy, which elevates the voice to the highest pitch.

f. Extreme sorrow, which also raises the voice to a high pitch. In the second line the voice should fall partially; and in the third line it should be still lower, but very forcible.

g. Here is an example of pleasing melancholy, which adopts a slow pronunciation, and a soft, low tone. The last three lines should be spoken in a monotone.

These examples show that in exclamatory sentences the *tone of the passion* should regulate the tone of the voice.

h. The reader would also do well to consider the particulars in this series as *emphatic*, and read the whole as a concluding series.

i. i. Where exclamatory sentences have the character of direct questions, they receive the rising inflection. Rule X., Note.

It is a period nowhere to be found
 In all the hoary registers of Time,
 Unless perchance in the *fool's* calendar.
 Wisdom *disclaims* the word, nor holds society
 With those who own it. No, my Horatio,
 'Tis *Fancy's* child, and *Folly* is its father;
 Wrought of such stuff as *dreams* are, and as baseless
 As the fantastic visions of the evening.—COTTON.

The bell strikes one. We take no note of time
 But from its loss: to give it then a tongue
 Is wise in man. As if an angel spoke,
 I feel the solemn sound. If heard aright,
 It is the knell of my departed hours.
 Where are they? With the years beyond the flood.
 It is the signal that demands dispatch:
 How much is to be done! My hopes and fears
 Start up alarmed, and o'er life's narrow verge
 Look down—on what? A fathomless abyss!
 A dread eternity! how surely mine!
 And can eternity belong to me,
 Poor pensioner on the bounties of an hour?—YOUNG.

a. There are tears['] for his love[']; joy['] for his fortune[']; honor['] for his valor[']; and death['] for his ambition['].

a. There are tears⁻ for his love[']; joy⁻ for his fortune[']; honor⁻ for his valor[']; and death['] for his ambition['].

- b. Do you think he will come to-day?'
 Do you think he will come to-day?' said John'.
 Am I my brother's keeper? said the unhappy man'.
- b. Where are you going?'
 Where are you going?' said John'.
- c. For Heaven's['] sake, Hubert', let me not be bound!'
 Nay', hear['] me, Hubert! drive these men away',
 And I will sit as quiet as a lamb['];
 I will not stir['], nor wince['], nor speak a word',
 Nor look['] upon the irons angrily';
 Thrust but these men away', and I'll forgive['] you,
 Whatever torment you do put me to'.

Shylock. He hath disgraced['] me, and hindered me of half a million[']; laughed at my losses['], mocked at my gains['], scorned my nation['], thwarted my bargains['], cooled my friends['], heated mine enemies[']; and what's his reason[']? I am a Jew[']! Hath not a Jew eyes[']? hath not a Jew hands['], organs['], dimensions['], senses['], affections['], passions[']? fed with the same food['], hurt with the same weapons['], subject to the same diseases['], heated by the same means['], warmed and cooled by the same winter and summer as a Christian is? if you prick['] us, do we not bleed[']? if you tickle['] us, do we not laugh[']? if you poison['] us, do we not die[']? and if you wrong['] us, shall we not revenge[']? if we are like you in the rest['], we will resemble you in that. If a Jew['] wrong a Christian['], what is his humility[']? revenge[']; if a Christian['] wrong a Jew['], what should his sufferance['] be by Christian example[']? why, revenge[']. The villainy you teach['] me I will execute[']; and it shall go hard['] but I will better['] the instruction.

a. a. See Note to Rule VIII. Here are two different readings of the same passage, and each has its advocates. The first rendering supposes that the words were spoken with little or no depth of feeling; the second gives to them a considerable degree of intense feeling and emphatic solemnity. Those who agree as to the meaning will read the passage alike. It is not, therefore, the principles of elocution that are at fault here, but the impossibility of knowing, in this as in thousands of other instances, what were the exact sentiments and emotions of the speaker. (See also p. 20.)

b. b. Not only has a direct question the rising slide, but a succeeding dependent circumstance takes the rising slide also. A dependent circumstance following an indirect question also takes the rising slide. The principle in both cases will be made apparent, as already explained, by restoring the natural order of the sentences. Thus:

John said', do you think he will come to-day?'

John said', where are you going?'

For the inflection after "said," see Rule II.

c. This is spoken throughout in the tone of plaintive entreaty.

FIRST MISCELLANEOUS DIVISION.



LESSON I.—GREEN RIVER.

1. WHEN breezes are soft and skies are fair,
I steal an hour from study and care,
And hie me away to the woodland scene,
Where wanders the stream with waters of green,
As if the bright fringe of herbs on its brink
Had given their stain to the wave they drink;
And they, whose meadows it murmurs through,
Have named the stream from its own fair hue.

2. How pure its waters ! its shallows are bright
With colored pebbles and sparkles of light,
And clear the depths where its eddies play,
And dimples deepen and whirl away.
Oh, loveliest there the spring days come,
With blossoms, and birds, and wild bees' hum ;
The flowers of summer are fairest there,
And freshest the breath of the summer air ;
And sweetest the golden autumn day
In silence and sunshine glides away.
3. Yet, fair as thou art, thou shunnest to glide,
Beautiful stream ! by the village side ;
But windest away from haunts of men,
To quiet valley and shaded glen ;
And forest, and meadow, and slope of hill,
Around thee, are lonely, lovely, and still.
Lonely, - save when, by thy rippling tides,
From thicket to thicket the angler glides ;
Or the simpler comes with basket and book,
For herbs of power on thy banks to look ;
Or haply, some idle dreamer, like me,
To wander, and muse, and gaze on thee.
Still, - save the chirp of birds that feed
On the river cherry and seedy reed,
And thy own wild music gushing out
With mellow murmur and fairy shout,
From dawn to the blush of another day,
Like traveler singing along his way.
4. I often come to this quiet place,
To breathe the airs that ruffle thy face,
And gaze upon thee in silent dream,
For in thy lonely and lovely stream
An image of that calm life appears
That won my heart in my greener years.—BRYANT.

LESSON II.—THE BEST KIND OF REVENGE.

1. SOME years ago, a warehouseman in Manchester, England, published a scurrilous¹ pamphlet, in which he endeavored to hold up the house of Grant Brothers to ridicule. William Grant remarked upon the occurrence that the man would live to repent what he had done ; and this was conveyed by some tale-bearer to the libeler,² who said, " Oh, I suppose he thinks I shall some time or other be in his debt ; but I will take good care of that." It happens, however, that a man in business can not always choose who shall be his creditors.³ The pamphleteer became a bankrupt,⁴ and the brothers held an acceptance⁵ of his which had been indorsed⁶ to them by the drawer,⁷ who had also become a bankrupt.

2. The wantonly-libeled men had thus become creditors of the libeler! They now had it in their power to make him repent of his audacity. He could not obtain his certificate without their signature, and without it he could not enter into business again. He had obtained the number of signatures required by the bankrupt law except one. It seemed folly to hope that the firm of "the brothers" would supply the deficiency. What! they, who had cruelly been made the laughing-stocks of the public, forget the wrong and favor the wrong-doer? He despaired. But the claims of a wife and children forced him at last to make the application. Humbled by misery, he presented himself at the counting-house of the wronged.

3. Mr. William Grant was there alone, and his first words to the delinquent were, "Shut the door, sir!"—sternly uttered. The door was shut, and the libeler stood trembling before the libeled. He told his tale, and produced his certificate, which was instantly clutched by the injured merchant. "You wrote a pamphlet against us once!" exclaimed Mr. Grant. The supplicant expected to see his parchment thrown into the fire. But this was not its destination. Mr. Grant took a pen, and, writing something upon the document, handed it back to the bankrupt. He, poor wretch! expected to see "rogue, scoundrel, libeler" inscribed, but there was, in fair round characters, the signature of the firm.

4. "We make it a rule," said Mr. Grant, "never to refuse signing the certificate of an honest tradesman, and we have never heard that you were any thing else." The tears started into the poor man's eyes. "Ah!" said Mr. Grant, "my saying was true. I said you would live to repent writing that pamphlet. I did not mean it as a threat. I only meant that some day you would know us better, and be sorry you had tried to injure us. I see you repent of it now." "I do, I do!" said the grateful man; "I bitterly repent it." "Well, well, my dear fellow, you know us now. How do you get on? What are you going to do?" The poor man stated that he had friends who could assist him when his certificate was obtained. "But how are you off in the mean time?"

5. And the answer was, that, having given up every farthing to his creditors, he had been compelled to stint his family of even common necessities, that he might be enabled to pay the cost of his certificate. "My dear fellow, this will not do; your family must not suffer. Be kind enough to take this ten-pound note to your wife from me. There, there, my

dear fellow! Nay, don't cry; it will be all well with you yet. Keep up your spirits, set to work like a man, and you will raise your head among us yet." The overpowered man endeavored in vain to express his thanks: the swelling in his throat forbade words. He put his handkerchief to his face, and went out of the door crying like a child.—CHAMBERS.

¹ SOÛR'-BIL-IOUS, grossly abusive.

² LI'-BEL-ER, one who, in a written article, wantonly injures the reputation of another.

³ CRÉD'-IT-OR, one to whom another is indebted.

⁴ BĀNK'-RUPT, one who can not pay his debts.

⁵ AC-CÉPT'-ANCE, in commerce, is the accepting or signing of a bill or order, so as to bind the acceptor to make payment.

⁶ IN-DÔRSE', to write one's name on the back of a note, etc., so as to become liable to pay it.

⁷ DRĀW'-ER, the maker of a note.

LESSON III.—A MODEST WIT.

1. A SUPERCILIOUS¹ nabob² of the East—
 Haughty, being great—purse-proud, being rich—
 A governor, or general, at the least,
 I have forgotten which—
 Had in his family a humble youth,
 Who went from England in his pātron's³ suite,
 An unassuming boy, and in truth
 A lad of decent parts, and good repute.
2. This youth had sense and spirit;
 But yet, with all his sense,
 Excessive diffidence
 Obscured his merit.
3. One day, at table, flush'd with pride and wine,
 His honor, proudly free, severely merry,
 Conceived it would be vastly fine
 To crack a joke upon his secretary.⁴
4. "Young man'," he said, "by what art', craft', or trade',
 Did your good father' gain a livelihood?"—
 "He was a saddler', sir," Modestus said,
 "And in his time was reckon'd good."
5. "A saddler', eh'! and taught you Greek,
 Instead of teaching you to sew'⁵
 Pray, why did not your father make
 A saddler, sir, of you'?"
6. Each parasite,⁶ then, as in duty bound,
 The joke applauded, and the laugh went round.
 At length Modestus, bowing low,
 Said (craving pardon if too free he made),
 "Sir, by your leave, I fain would know
 Your' father's trade!"
7. "My father's trade'! by heaven, that's too bad!
 My father's trade'? Why, blockhead, are you mad?"

My father, sir, did never stoop so low—
He was a gentleman, I'd have you know."

8. "Excuse the liberty I take,"
Modestus said, with archness on his brow,
"Pray, why did not your father make
A gentleman of *you*?"—*Anon.*

¹ SU-PER-CİL'-I-OUS, lofty with pride.

² NĀ'-BOB, a man of great wealth.

³ PĀ'-TRON, a guardian or protector.

⁴ ŠĚc'-RE-TA-RY, one employed to write letters; a chief clerk.

⁵ SEW, pronounced *sō*.

⁶ PĀR'-A-SĪTE, a sycophant; flatterer.

LESSON IV.—THE ELOQUENCE OF ACTION.

1. WHEN public bodies are to be addressed on momentous occasions, when great interests are at stake and strong passions excited, nothing is valuable in speech further than it is connected with high intellectual and moral endowments. Clearness, force, and earnestness are the qualities which produce conviction. True eloquence, indeed, does not consist in speech. It can not be brought from far. Labor and learning may toil for it', but they will toil in vain'. Words and phrases may be marshaled in every way', but they can not compass' it. It must exist in the man', in the subject', and in the occasion'. Affected passion', intense expression', the pomp of declamation', all may aspire after it'—they can not reach' it. It comes, if it come at all, like the outbursting of a fountain from the earth, or the bursting forth of volcanic fires, with spontaneous, original native force.

2. The graces taught in the schools, the costly ornaments and studied contrivances of speech, shock and disgust men when their own lives, and the fate of their wives, their children, and their country, hang on the decision of the hour. Then, words have lost their power, rhetoric is vain, and all elaborate oratory contemptible. Even genius itself then feels rebuked and subdued, as in the presence of higher qualities. Then, patriotism is eloquent; then, self-devotion is eloquent. The clear conception, outrunning the deductions of logic, the high purpose, the firm resolve, the dauntless spirit, speaking on the tongue, beaming from the eye, informing every feature, and urging the whole man onward, right onward, to his object—this, this is eloquence; or, rather, it is something greater and higher than all eloquence—it is action, noble, sublime, godlike action!—DANIEL WEBSTER.

LESSON V.—USE PLAIN LANGUAGE.

1. WHAT do you say? What? I really do not understand you. Be so good as to explain yourself again. Upon my word, I do not! Oh! now I know: you mean to tell me it is a cold day. Why did you not say at once, "It is cold to-day?" If you wish to inform me it rains or snows, pray say, "It rains," "It snows;" or, if you think I look well, and you choose to compliment me, say, "I think you look well." "But," you answer, "that is so common and so plain, and what every body can say." "Well, and what if every body can? Is it so great a misfortune to be understood when one speaks, and to speak like the rest of the world?"

2. I will tell you what, my friend—you do not suspect it, and I shall astonish you—but you, and those like you, want common sense! Nay, this is not all; it is not only in the direction of your wants that you are in fault, but of your superfluities; you have too much conceit; you possess an opinion that you have *more* sense than others. That is the source of all your pompous nothings, your cloudy sentences, and your big words without a meaning. Before you accost a person, or enter a room, let me pull you by the sleeve and whisper in your ear, "Do not try to show off your sense: have none at all; that is your cue. Use plain language, if you can; just such as you find others use, who, in your idea, have no understanding; and then, perhaps, you will get credit for having some."—LA BRUYÈRE.

LESSON VI.—THE THREE BLACK CROWS.

[It must be remembered that where the circumflex is used (ˆ) in the *reading lessons*, it does not designate the character of the vowel sound, but the nature of the *inflection*.]

1. Two honest tradesmen meeting in the Strand,
 One took the other briskly by the hand:
 "Hark ye," said he, "'tis an odd story this,
 About the crows!" "I don't know what it is,"
 Replied his friend. "No? I'm surprised at that:
 Where *I* come from, it is the common chat:
 But you shall hear: an odd affair indeed!
 And that it happened, they are all agreed:
 Not to detain you from a thing so strange,
 A gentleman, that lives not far from 'Change,
 This week, in short, as all the alley knows,
 Taking a puke, has thrown up three black crows."

2. "Impossible'!" "Năy, but it's really true';
 I had it from good hands, and so may you."
 "From whose', I pray'?" So, having named the man,
 Straight to inquire his curious comrade ran.
 "Sir', did you tell"—relating the affair—
 "Yes', sir', I did'; and if it's worth your care,
 Ask Mr. Such-a-one'; he told it me;
 But, by-the-by, 'twas *two'* black crows, not *three'*."
3. Resolved to trace so wondrous an event,
 Whip to the third the virtuoso went.
 "Sir"—and so forth—"Why, yes; the thing is fact,
 Though in regard to number not exact;
 It was not *two* black crows'; 'twas only *one'*;
 The truth of *that* you may depend' upon:
 The gentleman himself told me the case."
 "Where' may I find' him?" "Why, in such a place."
4. Away he goes, and having found him out—
 "Sir, be so good as to resolve a doubt."
 Then to his last informant he referred,
 And begged to know if true what he had heard.
 "Did you, sir, throw up a black crow'?" "Not' I'!"
 "Bless' me! how people propagate a lie'!
 Black crows have been thrown up, three, two, and one,
 And here I find at last all comes to none!
 Did you say nothing of a crow at all'?"
 "Crōw—crōw—perhaps I might', now I recall
 The matter over'." "And pray, sir, what was't?"
 "Why, I was horrid sick, and, at the last,
 I *did'* throw up, and told my *neighbor'* so,
 Something that was as *black*, sir, as a *crow*."—BYRON.

LESSON VII.—WHAT IS A GENTLEMAN?

1. A GENTLEMAN is just a *gentle*-man; no more, no less; a diamond polished, that was first a diamond in the rough. A gentleman is gentle. A gentleman is modest. A gentleman is courteous. A gentleman is generous. A gentleman is slow to take offense, as being one that never gives it. A gentleman is slow to surmise evil, as being one that never thinks it. A gentleman goes armed only in consciousness of right. A gentleman subjects his appetites. A gentleman refines his taste. A gentleman subdues his feelings. A gentleman deems every other better than himself.

2. Sir Philip Sidney was never so much a gentleman—mirror though he was of England's knighthood—as when, upon the field of Zutphen, as he lay in his own blood, he waived the draught of cold spring water that was brought to quench

his mortal thirst in favor of a dying soldier. St. Paul described a gentleman when he exhorted the Philippian Christians: "Whatsoever things are just, whatsoever things are pure, whatsoever things are lovely, whatsoever things are of good report, if there be any virtue, and if there be any praise, think on these things."—G. W. DOANE.

LESSON VIII.—WHAT IS TIME?

1. I ASKED an aged man, a man of cares,
Wrinkled and curved, and white with hoary hairs;
"Time is the warp of life," he said: "oh tell
The young, the fair, the gay, to weave it well!"
I asked the ancient venerable dead',
Sages who wrote', and warriors who bled';
From the cold grave a hollow murmur flowed,—
"Time sowed the seed we reap in this abode!"
2. I asked a dying sinner, ere the tide
Of life had left his veins: "Time!" he replied,
"I've lost' it! ah! the treasure'!" and he died.
I asked the golden sun, and silver spheres,
Those bright chronometers of days and years:
They answered, "Time is but a meteor glare!"
And bade us for eternity prepare.
3. I asked a spirit lost'; but oh— the shriek
That pierced my soul'! I shudder while I speak!
It cried, "A particle'! a speck'! a mite
Of endless years, duration infinite!"
Of things inanimate, my dial I
Consulted, and it made me this reply:
"Time is the season fair of living well',
The path of glory', or the path of hell'."
4. I asked old Father Time himself, at last,
But in a moment he flew swiftly past;
His chariot was a cloud, the viewless wind
His noiseless steeds, which left no trace behind.
I asked the mighty angel, who shall stand
One foot on sea, and one on solid land;
"By heavens!" he cried, "I swear the mystery's o'er;
Time *was*," he cried, "but TIME SHALL BE NO MORE!"

MARSDEN.

TIME is the cradle of hope', but the grave of ambition'; the salutary counselor of the wise', but the stern corrector of fools'. Wisdom walks before it', opportunity with it', and repentance behind' it: he that has made it his friend', will have little to fear from his enemies'; but he that has made it his enemy', will have but little to hope from his friends'.—LACON.

PART II.
THIRD DIVISION OF ZOOLOGY;
EMBRACING
HERPETOLOGY,
OR THE NATURAL HISTORY OF REPTILES.

[For the 1st and 2d Divisions of Zoology, see Third and Fourth Readers.]



REPRESENTATIVES OF THE FOUR ORDERS OF THE REPTILE RACE.—The Lizard; the Fresh-water Terrapin, or Turtle; the Adder; and a South American Frog, with "horned eyelids."

LESSON I.—INTRODUCTORY VIEW.

1. The two divisions of animal life already described in the Third and Fourth Readers embrace the Mammalia and the Birds, which are called the *warm-blooded* Vertebrates,¹ because they have warm blood, and a jointed back-bone or spinal column. The third division, which is composed of the REPTILES, and the fourth, which is composed of the FISHES, embrace the *cold-blooded* Vertebrates, which are so called because a spinal column, more or less apparent,² is found in all of them, and their natural temperature,³ although

their blood is red, is but little, if at all, above that of the atmosphere or water in which they dwell. To our touch they appear decidedly cold. In this and a few succeeding lessons we are to treat of *Herpetology*, or the natural history of reptiles.

2. "It can not be denied," says Swainson, "that the form which nature has assumed in this division of animal life is associated in most minds with deformity or with horror. Yet, however the bulk of mankind may turn with disgust from the contemplation of these creatures, the philosophic observer, who knows that every thing which has proceeded from the hand of Omnipotence is, in its kind, good and perfect, will patiently investigate⁴ their history, and will endeavor to illustrate, in these despised and repulsive animals, those sublime truths of UNITY OF PLAN, which are as perfect and apparent in the character of a loathsome reptile as in the formation of a Paradise-bird."

3. The skeleton of reptiles presents much greater variations in structure⁵ than are found in the warm-blooded vertebrates. Indeed, all the parts of which the skeleton of reptiles is composed, excepting the head and the vertebrated column and ribs, are wanting in one or another group; yet in such of the bones as are found we may trace a striking resemblance to the corresponding bones of mammalia and birds. Throughout all the divisions of animal life the changes of form are very gradual.

4. Although reptiles, with the exception of amphibians⁶ during a part of their existence, breathe by means of lungs, their circulating apparatus is not so perfect as in the mammalia and birds; for although the heart, in all but the amphibians,⁶ has two auricles,⁷ it has but one ventricle,⁸ into which both of the auricles open, and where the pure and impure blood are mingled, and then sent in part to the lungs, and in part to the body. The veins and arteries of reptiles, therefore, are not filled with pure red blood, like those of the mammalia and birds, but with an imperfect fluid not so well adapted to give them a high degree of life and vigor. Hence, as the animal heat is always in proportion to the quantity of respiration—to the amount of oxygen or fuel consumed—reptiles are comparatively cold-blooded. Their lungs are small; their circulation is slow; and as they consume less air than the mammalia, they are capable of living for a longer time without it.

5. In all cold-blooded animals, the vital principle is much

stronger than in those whose blood is warm. Their heart pulsates, in some cases, for many hours after it has been removed from the body; the tortoise will continue to live, and exhibit voluntary motion, for a considerable time after having lost its head. The physiologist Lewes affirms that a frog moved about *voluntarily* the day after he had removed its brain; and one was kept alive forty days after having been subjected to the total deprivation of its lungs. As might be expected from the character of their blood, its slow circulation, and the smallness of the brain, reptiles are in general sluggish and indolent in their habits of life, and obtuse⁹ in their sensations; and in cold countries they pass a great part of the winter in a dormant¹⁰ state. Almost all reptiles are carnivorous.¹¹ They produce their young from eggs, which they generally deposit in warm sandy places, leaving them to be hatched by the warmth of the atmosphere.

6. Reptiles have been divided, by most naturalists, into the following four orders or classes: first, the *Chelonians*, or tortoises; second, the *Saurians*, or lizards, which embrace the crocodiles; third, the *Ophidians*, or serpents; and fourth, the *Amphibians*, which embrace the frogs, toads, salamanders, and sirens—animals which undergo a wonderful transformation¹² at a certain period of their lives, from the nature and habits of fishes to those of the true land reptiles. Think not that the study of the nature, character, and habits of such creatures is unworthy the human intellect: they form links in the great chain of animated nature; and the *great whole* of this most interesting portion of God's creation can not be understood without a knowledge of the *parts* of which it is composed. We may well apply to this subject Pope's celebrated lines—

"From Nature's chain, whatever link you strike,
Tenth or ten thousandth, breaks the chain alike."

¹ VÉR'-TE-BRĀTE, an animal having a spine with joints.

² AP-PĀR'-ENT, easily seen; obvious.

³ TĒM'-PER-A-TŪRE, state of a body with regard to heat or cold.

⁴ IN-VĒS'-TI-GĀTE, examine into.

⁵ STRŪCT'-ŪRE, form, make, construction.

⁶ AM-PRĪB'-I-ANS, see page 72.

⁷ ĀU'-RI-CLE, one of the cavities of the heart

which receives the blood from the lungs or veins. See Fourth Reader, p. 49.

⁸ VĒN'-TRI-CLE, a cavity of the heart which propels the blood to the lungs or arteries. See Fourth Reader, p. 49.

⁹ OB-TŪSE', dull; not having acute sensibility.

¹⁰ DŌR'-MANT, sleeping; not active.

¹¹ CĀR-NĪV'-O-ROUS, feeding on flesh.

¹² TRANS-FORM-Ā'TION, change of form.

LESSON II.—A LETTER ABOUT THE CHELONIAN.¹

"What do you think of turtles'?" Such was the question asked me by a young friend and former pupil of mine, then on a visit with me to our great metropolis,² as, stepping out of a dining-saloon in Broadway, we stopped a moment to look at three enormous living sea-turtles that had just been deposited on the sidewalk from a dray-cart, with their backs downward to prevent them from running away. After some comments upon turtle-soup and aldermanic dinners, my young friend remarked that he knew very little about the better portion of the turtle family, and had a prejudice against the whole race: he had seen, he said, great numbers of ugly-looking mud-turtles in swamps and river-marshes, and he thought these reptiles were very well adapted, by their disagreeable appearance, to the places which they inhabit. With a promise to give my friend some account, by letter, of the turtle portion of the reptile kingdom, we parted; and now I proceed to make good my promise.

Dellwild, May 15th, 18—.

1. MY YOUNG FRIEND,—I begin this letter by recalling to your remembrance the substance of the remark which you made at our parting, "that turtles are peculiarly adapted to certain unpleasant localities which Nature seems to have set apart for them." A fit starting-place is this; for here, by your own admission, is a beautiful harmony³ in nature, which would not be if the loveliest of singing-birds inhabited the marshes, and turtles, lizards, and crocodiles crawled in our gardens. The same kind of harmony will be found to exist throughout earth, air, and water: the eagle and the condor naturally betake themselves to mountain heights far from the dwellings of man; gaudy sun-birds and delicate humming-birds

"gleam between
The crimson blossoms of the coral-tree
In the warm isles of India's sunny sea;"

the lion for the forests, the tiger for the jungles, the fishes for the waters, and why not reptiles to *crawl* upon the earth, and turtles to wallow in the marshes? You may lay it down as a principle to begin with, that the harmony³ of nature would be incomplete if every nook of creation were not filled with its *appropriate* inhabitants.

2. But perhaps it may serve to give these lowly creatures

a greater degree of importance in your estimation, and dignify the study of their character and habits, to learn (if you are ignorant of it) that the celebrated naturalist⁴ Agassiz⁵ has devoted the greater part of one of his folio⁶ volumes upon the Natural History of the Animals of this Country to the subject of tortoises alone, and that he has filled the greater part of another volume with exquisite⁷ drawings of these animals. Do you think it was time wasted on his part? or that the cause of science will not be benefited by his labors? Not content with information at second-hand, he has examined hundreds, and probably thousands, of the living animals themselves, and from his own personal knowledge has written his descriptions and made his drawings.

3. "Surely," you say, "he must have traveled much, and waded through swamps and marshes innumerable, to have found so many of these disgusting animals!" By no means. Breaking in upon the natural harmony to which we have alluded, he had his garden full of them, in the city of Cambridge, near Boston; and there he walked among them daily, fed them, and studied their character and habits. "But," you ask, "how did he obtain them?" Scientific men from all parts of our country collected them for him, and sent them to him. Thus Agassiz tells us that a gentleman of Natchez, Mississippi, not satisfied with collecting, extensively, the turtles in the neighborhood of his residence, undertook a journey of many hundred miles for the special purpose of securing all the species living in the adjoining regions, and, having completed the survey, set out with a cargo of living turtles, and brought them safely alive to him in Cambridge, after a journey of over a thousand miles.

4. I think you will agree with me that if such a man as Agassiz, whose name is every where honored for his contributions to science, devotes so much time to the study of tortoises, and publishes costly books to explain their structure and describe their habits, it is surely not unworthy a student's ambition to learn something about these animals, and the position which they occupy in the kingdom of animated nature. You will doubtless admit that it is very desirable, to say the least, in an age when natural history is receiving so much attention, to have some general knowledge of all its great divisions, that of herpetology among the rest, that you may not be wholly ignorant of what the learned are so much interested in.

5. Let me remind you of another advantage which will be

the natural result of a more extended acquaintance with this subject. The feelings of disgust with which, doubtless, the sight of most reptiles now fills you, will give way to some degree of satisfaction at least, if not of pleasure, by reason of the interest which a knowledge of their structure, character, and habits will excite in you. If we could look upon all God's creatures with pleasure, and find something to interest us in all of them, even the humblest, how much would our stock of general happiness be increased thereby!

6. But let us return to our subject, and see if we can not treat of it in a more scientific order. As tortoises are included in the great division of vertebrated animals, you will naturally ask, "for what reason?" I reply, "Because they have a back-bone or spinal column." "But the tortoise," you say, "is a soft animal, between two shells, and I see no such bone in its body."



Upper shell of Tortoise.

Let me explain to you. The back-bone of the tortoise is on the *outside* of the body, and forms a part of its shell, or covering. Here is a drawing which will make it all plain to you. It represents the under side of the upper shell of the tortoise, with the bones of the limbs attached in their proper places. Downward through the length of the shell runs the spinal column; branching out from each side of it are the flat ribs, which have so grown together as to leave only a mere line-mark to show where they are

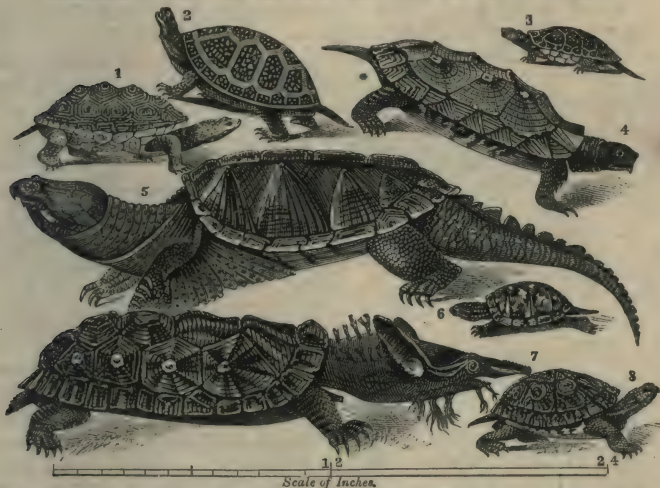
united. Thus the spinal column and the ribs grow on the outside, so as to form the upper shell of the animal.

7. "This is wonderful," you say; "what I had never thought of before." Do you see any wisdom', or apparent design', in such an arrangement'? The tortoise, when on land, is a slow animal, and it has a soft body, which, if unprotected, would be easily crushed, or destroyed by other animals. The peculiar growth of its back-bone and ribs has given it a firm bony shell to protect it from above; and in a similar manner the breast-bone, or sternum (which has been removed in the drawing), spreads out, in a shell-like form, extending from the base of the neck to the tail. By this singular provision the turtle is incased in a coat of bony armor, formed of its own skeleton! It will be well for you to recollect that the upper shell is called the *carapace*,⁸ and the lower one the *plastron*.

8. The Chelonian order of reptiles (for it is well to know the terms which scientific men use)—the Chelonians, I say, may be conveniently divided into the three following families: land tortoises, river and marsh tortoises, and marine turtles; although Agassiz divides them into two classes, with seven families in one, and two in the other, placing the land tortoises and the river and marsh tortoises in one class, and the marine turtles in the other. I shall not have room in this letter to describe any of these classes or families, but in my next I will give you some account of a few of the most important or most noted species.

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|--|---|
| 1 CHE-LÖ'-NI-AN, from the Greek <i>chel-o-ne</i> , a tortoise. | 5 AG-AS-STZ (<i>äg'-ä-sē</i> , or <i>a-gäs'-siz</i>). |
| 2 ME-TRÖP'-O-LIS, chief city (New York). | 6 FÖ'-LI-O, a book formed by once doubling each sheet of paper. |
| 3 HÄR'-MO-NY, just adaptation of parts to each other. | 7 EX'-QUI-SITE, choice; exceedingly beautiful. |
| 4 NÄT'-Ü-RAL-IST, one versed in natural his- | 8 CÄR-Ä-PÄÖE'. |

LESSON III.—A SECOND LETTER ABOUT TURTLES.



LAND, MARSH, AND RIVER TORTOISES.—1. Salt-water Terrapin, *Emys palustris*. 2. Blanding's Tortoise, *Cistuda Blandingii*. 3. Spotted Tortoise, *Emys guttata*. 4. Fresh-water, or Wood Terrapin, *Emys insculpta*. 5. Alligator Tortoise, or Snapping Turtle, *Emysaura serpentina*. 6. Common Mud-Turtle, or Musk Tortoise, *Sternotherus odoratus*. 7. Matamata Tortoise, *Chelys matamata*. 8. Common Box-Tortoise, *Cistuda Carolina*. (Nos. 2 and 8 are Land Tortoises.)

Dellwild, May 24th, 18—.

1. MY YOUNG FRIEND,—I proceed now to fulfill the promise which I made in my last letter. Among the land tor-

toises, which vary from a few inches to three or four feet in length, the best known to us is the little box-tortoise, which is found every where in this country on dry land. (See No. 8.) It is a very gentle and timid animal, never takes to the water from choice, and feeds on insects and fruit. The little land tortoise of Europe is extensively used in Greece for food. One kept in the garden of Lambeth Palace, near London, lived to the age of one hundred and twenty years. Some of the largest land tortoises, often weighing two or three hundred pounds, are often found on the Galapagos¹ Islands, where they are considered wholesome and palatable² food. They are eagerly sought for by crews of vessels, as they serve for fresh meat, and can be kept for a year in the hold of a ship without food or drink. In some of the land tortoises, the lower shell, or plastron, is so jointed that the animal, after drawing in its limbs, can shut the doors of its portable house against its enemies.

2. Of the marsh and river tortoises there is a great variety, differing much in size and character. Of these, a great many species, some of which are commonly known as terrapins, and others as mud-turtles, are found in this country. The well-known and justly prized terrapin of epicures,³ which is called the salt-water terrapin, because it is found exclusively in salt or brackish streams near the sea-shore, is quite abundant on the shores of Long Island. During the winter it buries itself in the mud, from which it is taken in great numbers in early spring, and is then very fat.

3. Among the river tortoises is the well-known alligator tortoise, or *snapping turtle*, which derives its name from its propensity to snap at every thing within its reach. It will snap greedily at the legs of ducks in a pond, and drag them under water to be devoured at leisure. In the Southern United States this and other river turtles destroy great numbers of young alligators. Another large river turtle, also frequently called "snapping turtle," and found abundantly in the rivers which enter the Gulf of Mexico, we have represented in the engraving on the next page. But I must not omit to mention the *matamata*, found in South America. It is the most remarkable of the river tortoises. Look at the drawing of it! What a hideous looking object! Yet its flesh is much esteemed for food, and it is angled for with a hook and line. It is an ugly creature to deal with, as it bites sharply; and the fishermen generally cut off its head as soon as they have caught it.

4. And, lastly, I must describe to you, briefly, the marine tortoises, which are considered the only *true* turtles. You will at once distinguish them from all others by the paddle-like form of their feet, the toes being concealed by the skin, which completely envelops⁴ them. These animals, which are found in all the seas of warm climates, are excellent swimmers, but on land they shuffle along in a very awkward manner, and make only a slow progress. The best-known species is the green turtle, which is often seen in the markets of New York, and is well known to the epicure for its delicious steaks, and the savory soup which it affords. The eggs of this, and, indeed, of all sea-turtles, are also eaten, and considered a great delicacy. These turtles are generally taken by watching them when they visit the shore to deposit their eggs; they are then turned over on their backs, and in this helpless condition they remain until their captors, having secured in the same manner as many as they require, carry them off to their ships.



MARINE AND RIVER TURTLES.—1. Hawk's-bill Turtle, *Chelonia imbricata*. 2. Logger-head Turtle, *Chelonia caretta*. 3. Green Turtle, *Chelonia mydas*. 5. Leathery Turtle, *Sphargis coriacea*. 4. & 6. Upper and under sides of the *Chelonura Temminckii*, a "Snapping Turtle" of the Mississippi.

5. Another species of sea-turtle, called the hawk's-bill, which

receives its popular name from the curved and pointed form of the upper jaw, furnishes the valuable tortoise-shell of commerce. The upper shell of this species consists of thirteen plates, partly overlapping each other like the tiles of a house. By means of heat these plates are capable of being firmly united in any quantity, and of receiving any shape by being pressed between metallic moulds. Those which produce the finest shell are taken in the waters of the Indian Archipelago. But the largest of the sea-turtles is the loggerhead, which sometimes weighs eleven hundred pounds. It is found occasionally on the shores of nearly all the Atlantic States, is a strong swimmer, and is frequently seen in the midst of the ocean, floating on the surface of the waters, motionless, and apparently asleep, in which situation it is easily captured.

6. Thus I have given you a very brief description of the turtle family, which comprises the first division or order of the class of reptiles. From what I have written, and from the drawings which I have given you, do you see any thing decidedly disagreeable or offensive in these animals? On the contrary, is it not probable that you might, like an Agassiz, become much interested in studying the peculiarities of their structure, their character, and their habits? I might give you statistics of their commercial importance, and many interesting accounts of their habits from the pages of Audubon, Darwin, and others, and I regret that I have not room for them here. One thing which I had overlooked I must however remind you of, and that is, you must not forget that all the turtles, even those that *live* in the sea, can breathe only when they are out of the water, and that, like whales, porpoises, and dolphins, they must occasionally come to the surface for a supply of air. Large numbers of sea-turtles may sometimes be seen in the clear waters of the Indian Seas feeding upon sea-weeds at the bottom, and in that situation they are represented as appearing like so many cattle browsing⁵ upon the herbage. Like herds of bison, they probably have their ranges—their paths over the hills, and through the valleys of the sea, from one pasture-ground to another. Who shall doubt that their life beneath the waters is a happy one?

¹ GAL-A-PĀ'-GOS, the "islands of tortoises," are west of South America.

² PĀL'-A-TA-BLE, agreeable to the taste.

³ EP'-I-CURE, one who indulges in the luxuries of the table.

⁴ EN-VÊL'-OPS, covers; incloses.

⁵ BROWS'-ING, feeding on branches.

LESSON IV.—A LETTER ABOUT THE SAURIANS.¹

LIZARD DIVISION OF THE SAURIANS.—1. Brazilian, or Variegated Lizard, *Teius teguexin*. 2. Sand-Lizard, *Lacerta agilis*. 3. New York Striped Lizard, or Blue-tailed Skink, *Scincus fasciatus*. 4. The Common Gecko, *Gecko verus*. 5. The Iguana, *Iguana tuberculata*. 6. Mitred Basilisk, *Basiliscus mitratus*. 7. Brown Swift, or Pine Lizard, *Tropidolepis undulatus*. 8. The Chameleon, *Chameleon vulgaris*.

Dellwild, June 2d, 18—.

1. MY YOUNG FRIEND,—The interest with which you profess to have read my letters descriptive of the Chelonian order of reptiles induces me to comply with your request that I should give you some account of the remaining three orders. These are, as you are already informed, the order of Saurians or Lizards, in which is included the crocodiles; the order of Ophidians or Serpents; and, lastly, the Amphibians, which are the connecting link between reptiles and fishes. As I purpose to treat these three orders within the limits of at most three letters, my description must be very brief indeed.

2. We will take the Saurian reptiles, or lizards proper, to begin with. Very offensive-looking animals many of them are, no doubt, to one not accustomed to them; but is it not probable that your feelings have been somewhat prejudiced against them? Perhaps more familiarity with these creatures

might induce you to look upon them with a greater degree of complacency.² Fancy yourself a resident of the torrid zone, where the forests, the fields, and even the houses swarm with them, and what a living torment it would be if you were to be constantly annoyed by the very sight of them! If you purpose a Southern residence, I advise you, for your own comfort, to overcome these prejudices.³

3. We have very few of the lizard family in the United States—only about a dozen species at most, and of these only two are found in New York and the New England States, and these are harmless little creatures, only six or eight inches in length. You may have been told that they are poisonous, a charge which I scornfully repel. It is merely a vulgar error, and is not true of *any* of the lizard race. The hotter climates of the globe are, as I have said, the great nurseries of the Saurians, and we of the temperate zone can form no adequate⁴ idea of the variety—no, nor of the *beauty* of these creatures, as found in their favorite abodes. This is what a writer says of them: "In the latitudes between the tropics they every where obtrude themselves upon notice; they are in the common pathway, and even haunt the abodes of men; they swarm upon the trees, they lie motionless upon the surface of the water, enjoying the hot rays of the sun; they cover banks, and walls, and crumbling ruins, and mingle their sparkling hues with those of the blooming vegetation amid which they nestle." Nice little creatures, that nestle so cozily⁵—perhaps beneath the very flowers that you are plucking!

4. The drawing at the head of this lesson, which I have prepared with much care, will give you a better idea than any description would convey of the lizards proper, leaving the crocodiles for another drawing. The little New York lizards, and the sand-lizard of England, are so small as scarcely to attract our notice. The Brazilian, or variegated lizard, is quite a different animal, sometimes measuring five or six feet in length. It runs with great swiftness, and strikes such violent blows with its tail that dogs do not readily venture to attack it. It is somewhat noted for robbing hen-roosts and stealing honey. It attacks the bee-hives with blows of its tail, running away each time, after having given a stroke, to escape the stings. In this way it wearies out the bees, who finally quit their home, and leave the honey to their enemy.

5. Another large South American lizard is the iguana, a drawing of which I have given. What would you think of eating such a creature? Do not be astonished when I tell

you that, in countries where it abounds, its flesh is regarded as a great delicacy! But it is an animal of *taste* in more senses than one. It is very fond of music. It passes a great part of its existence in trees, and is commonly taken when resting on a branch, by slipping a noose over its head, its captor whistling to it while engaged in the operation.

6. The chameleon, another member of the lizard family, we have all read of in that story of the "two travelers of conceited cast," who,

"As o'er Arabia's wilds they passed,
And, on their way, in friendly chat,
Now talked of this, and then of that,
Discoursed a while, 'mongst other matter,
Of the chameleon's form and nature."

You know how violent a dispute they fell into about its color, one declaring it to be blue, and the other green, and that

"So high, at last, the contest rose,
From words they almost came to blows;"

and yet the reptile, on being produced by a third party, was found to be neither green, nor blue, nor black—but white!

7. The truth about this power of the chameleon to change its color is this. It is naturally of a pale gray color, from which it may pass from pale green to yellow, and dingy red; and sometimes the change is continued to dusky violet, or nearly black. In other respects, also, the chameleon is a very peculiar animal. It seems scarcely to possess the power of motion—walks with the greatest circumspection⁶—and frequently remains hours almost immovable. It can direct its eyes two different ways at once—one looking backward and the other forward. This animal feeds upon insects; and it may be a wonder to you how so sluggish a creature can seize them. The wonder will not be lessened when you are told that it seizes them with its tongue, which it darts forth instantaneously, often more than the length of the body, and that the end of the tongue is covered with a viscid⁷ secretion, by which the insects at which it is thrown are glued to it. As this motion of the tongue is so rapid as to be scarcely visible, it was the popular belief of the ancients that the chameleon fed on air alone.

8. But I must pass on to others of the lizard class. The basilisk of South America, although perfectly harmless, is a very hideous-looking reptile, as you may see from the picture of it. This term, *basilisk*, was applied by the ancients to a monster which existed only in their own imaginations, yet of which the most detailed accounts have been transmitted to

us. The name is derived from a Greek word signifying royalty; and the animal was represented as the king of the ser-



Flying Dragon,
Draco mbriatus.

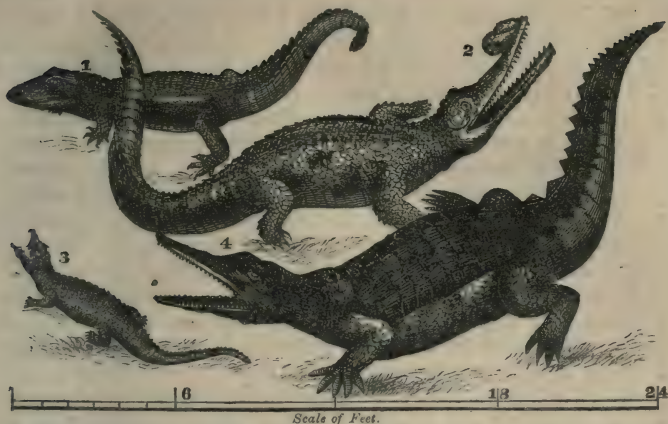
pents, with a regal crown upon its head, blighting the herbage with its breath, and striking dead with a glance of its eye. The term has been retained, and applied to this South American lizard on account of the crest or projection on its head. Another harmless little lizard, with a terrible name, is the flying dragon, which is found in India, and which is noted chiefly for being the only living representative of the fabulous dragons

of olden time, so celebrated in romance and fable.

9. I will allude to one more only of the true lizards, and that is the little, active, noiseless gecko, or house-lizard of India. The peculiar construction of its feet enables it to run up smooth perpendicular walls with great facility, and even to cross a ceiling with its back downward. It is partial to the habitations of men, attracted by the flies which swarm there. Thus Mrs. Mason, of the Baptist mission of Burmah, says of these creatures: "They are every where, under the sides of tables and chairs, in the closets and book-cases, and among the food and clothing. They sometimes tumble from the roof upon the tables, but they usually come struggling with a centipede,⁸ or some other vermin, in their mouths." So far from having any wish to destroy them, Mrs. Mason considered their services invaluable for clearing the house of vermin. It is supposed that this, instead of the spider, is the animal mentioned in the thirtieth chapter of Proverbs, and twenty-eighth verse, which has thus been rendered by Jerome:

"The gecko taketh hold with her hands,
And dwelleth in king's palaces,"

10. The crocodile division of the Saurians next claims our attention. The principal families are those of the alligator of our Southern States, the cayman of Brazil, the common crocodile of the Nile, and the gavial of the Ganges, all of which are represented in the annexed engraving, which will give you a better idea of their forms and relative sizes than any written description could convey. In the true crocodile the jaws are much more slim and pointed than in the alligator; and you will observe, at the end of the long snout of the gavial, a large protuberance,⁹ in which the nostrils are situated. All these animals are inhabitants of the rivers and fresh waters of warm countries; and, although they breathe



CROCODILE DIVISION OF THE SAURIANS.—1. Mississippi Alligator, *Alligator Mississippiensis*. 2. Gaviol of the Ganges, *Gavialis Gangetica*. 3. The Cayman, *Caiman palpebrosus*. 4. Egyptian Crocodile, *Crocodilus vulgaris*.

by means of lungs, they are capable of remaining under water an hour and a half at a time. Their near alliance¹⁰ to the tortoises is seen in the upper covering of their bodies, which is composed of numerous large, square, bony plates, set in a very tough leathery hide. In all of them both jaws are set round with formidable teeth; but the upper jaw only is movable. The following, descriptive of some of the habits of the crocodile, will be read with interest:

11. "The female digs a cavity in the earth, in which she places her eggs in a circular form, in successive layers, and with portions of earth between, the whole being afterward covered up. The nest is generally placed in a dry hillock, and the earth is gathered up, so that, on the average, the eggs are about ten inches below the surface. This being done, the mother abandons them to be hatched by the heat of the sun; yet instinct prompts her frequently to revisit the spot as the term of 'exclusion'¹¹ approaches. She then testifies uncommon agitation, roaming about the place, and uttering a peculiar growling, as if to awake her hideous offspring to animation.

12. "The period of maturity being at length attained, the nascent¹² crocodiles answer to her solicitude by a kind of yelping like puppies. A hollow murmur in return denotes her satisfaction, and she hastens to scrape up the earth with such anxiety that several of the young are generally crushed under her unwieldy body. Having withdrawn them from their nest, the mother leads them straightway to the neighboring water; but now her utmost vigilance is required for their preservation; for, unlike the instinct with which she is animated, the male, silently approaching, will frequently devour them before she is aware of their danger. He perpetually seeks their destruction; and the watch of the female over her young is protracted for three months from their first appearance."—GOODRICH.

13. The Mississippi alligators, which grow to the length of fourteen or fifteen feet, are the most fierce and voracious of the whole class; yet on land they are timid, and usually flee from the presence of man. During the heat of the day, these animals, if undisturbed, lie stretched and languid on the banks, or in the mud on the shores of the rivers and lagoons; but when evening comes they begin to move; and at this time, in certain seasons of the year, they commence a terrific roaring, which is described as a compound of the sounds of the bull and the bittern, but far louder than either. At this time two males will sometimes engage in fierce battle, usually in shallow water, and in these desperate fights not unfrequently both are killed. When the alligator closes its jaws upon an object, they can with difficulty be wrenched asunder, even by a lever of considerable length.

14. It is known that the crocodile of the Nile, which sometimes grows to the length of thirty feet, was regarded as sacred by the Egyptians, and that, when caught young, it was sometimes so trained as to march in the ranks of their religious processions. The gavial of the Ganges, which equals in size the Egyptian crocodile, though often represented as one of the scourges of that celebrated river, is not dangerous to man or the larger quadrupeds, although it is true that the dying Hindoos exposed upon its banks, and the dead body committed to its waters are its frequent prey.

15. There is a small animal in Egypt, called the ichneumon, which bears some resemblance to the weasel tribe, and which feeds upon birds, reptiles, and also upon eggs. It is particularly serviceable in restraining the multiplication of the crocodile by devouring its eggs, and also the young crocodile when newly hatched. This fact in natural history has been made use of in the following poem to illustrate the principle that it is much easier to remove an evil at its beginning than when it has grown to great proportions. The moral at the close of the poem may well be commended to the young.

1 SĀV'-RI-AN, from the Greek *sauros*, a lizard; an animal of the lizard kind.

2 Ċ'OM-PLĀ'-CEN-CY, pleasure; satisfaction.

3 PRĒS'-U-DĪCE, an opinion formed without due examination.

4 ĀD'-E-QUATE, correct; adequate ideas are such as exactly represent their object.

5 ĊŌ'-ZI-LY, snugly; comfortably.

6 CĪR-CUM-SRĒE'-TION, caution.

7 VĪS'-CID, sticky like glue.

8 CĒN'-TI-PĒD, an insect having a hundred feet; or one that has many feet.

9 PRO-TŪ'-BER-ANCE, a bunch or knob.

10 AL-LĪ'-ANCE, relationship.

11 EX-CLĒ'-SION, a thrusting out; hatching.

12 NĀS'-CENT, young; beginning to grow.

LESSON V.—THE CROCODILE AND THE ICHNEUMON.

1. On the banks of the fertile and many-mouthed Nile,
A long time ago lived a fierce crocodile,
Who round him was spreading a vast desolation,
For bloodshed and death seemed his chief occupation ;
'Twas easy to see no pity had he ;
His tears were but water—there all could agree.
2. The sheep he devoured, and the shepherd I ween ;
The herd feared to graze in the pasture so green,
And the farmer himself, should he happen to meet him,
The monster ne'er scrupled¹ a moment to eat him.
There never before was panic so sore
On the banks of the Nile as this creature spread o'er.
3. Wherever he went, all were flying before him,
Though some in their blindness thought fit to adore² him ;
But as they came near, each his suit to prefer,
This god made a meal of his base worshiper.
By day and by night it was his delight
His votaries³ to eat—it was serving them right.
4. Grown proud of his prowess, puffed up with success,
The reptile must travel—how could he do less ?
So one fine summer morning he set out by water
On a pleasure excursion—his pleasure was slaughter !
To Tentyra's isle, to visit awhile,
The careless inhabitants there to beguile.⁴
5. Though the Tentyrites thought themselves able before
To conquer each monster that came to their shore,
Yet now they, with horror, were fain to confess
That this crocodile gave them no little distress.
So in great consternation, a grand consultation
Was called to convene⁵ of the heads of the nation.
6. It met ; but, alas ! such the terror and fright,
They failed to distinguish the wrong from the right ;
When, just at this crisis, an ichneumon small
Stepped forth on the platform in front of them all,
With modesty winning, to give his opinion
Of measures and means to secure the dominion.
7. " Grave sirs," said he, bowing, " I see your distress,
And your griefs are, I fear me, past present redress ;
Yet still, if to listen should be your good pleasure,
I think I can help you, at least in a measure :
For 'tis my impression, a little discretion
Than valor itself is a far greater blessing.
8. " No doubt 'tis a noble and great undertaking,
Great war on a mighty great foe to be making ;
But still, I assure you, 'tis better by far
Not to let this great foe become mighty for war ;

While the crocodile lies in an egg of small size,
To crush him at once you should never despise.

9. "You see me before you a poor feeble creature;
Yet I cope⁶ with this monster, for such is my nature;
And while you have met here in grand consultation,
This one crocodile to expel from the nation,
I thought it a treat for breakfast to eat
A dozen or more, which I happened to meet."

MORAL.

10. And now that my fable is pretty near ended,
I think there should be a brief *moral* appended;
Beware how you let evil habits grow up;
While feeble and young, you to crush them may hope,
But let them remain till strength they attain,
You may find your best efforts to conquer them vain.

MRS. J. L. GRAY.

¹ SCÉU'-PLE, to doubt; to hesitate.

² A-DÔRE', to worship as divine.

³ VO'-TA-RIES, those devoted to him; his worshippers.

⁴ BE-GUILE', deceive; impose upon.

⁵ CON-VENE', assemble.

⁶ COPE, oppose with success.

LESSON VI.—A LETTER ABOUT THE OPHIDIANS.



THE OPHIDIANS, OR SERPENTS.—1. The Cobra-de-Capello, or Hooded Serpent of India, *Naja tripidians*. 2. The *Naja Haje* of Africa. 3. The Rattlesnake of America, *Crotalus durissus*. 4. European Black Viper, *Pelias berus*.

Dellwild, June 28th, 18—.

1. MY YOUNG FRIEND,—I am gratified to learn from you, in response to my last letter, that the brief description which I have given of the Saurian reptiles has not been devoid¹ of interest to you. Let me say to you, then, in this place, by way of further encouragement, that when you come to the subject of Geology, and find that the fossil remains of the Saurians, some of them of monster size, throw much light upon the history of the earth's formation, you will begin to realize something of the true importance of this and kindred portions of natural history, and see beauties in them which I can not expect you now to appreciate. But I must proceed to the subject set apart for this letter—the Ophidians, or Serpents, which comprise the third division or order of the reptile race.

2. In the little space which I can devote to this order in one letter, I can do little more than take a general view of the subject, and give you drawings of a few species. This you may not regret, as the very name of serpent, or *snake*, almost makes some people shudder; and I am not surprised that you should ask, "What *can* there be interesting about such creatures?"* I shall not attempt here to combat prejudices which seem so *natural*, and which were perhaps designed by the Great Author of our being.

3. Although many of the serpents are of the most resplendent coloring, and although, deprived of feet, fins, or other obvious members² for walking, they glide on the earth, ascend trees, and even direct their course through the waters with surprising agility and with graceful evolutions,³ yet the serpent was cursed "above every beast of the field;" and man, as if remembering this curse and the lamentable event which caused it, turns from the reptile with disgust and horror, or seeks to effect its instant destruction.

4. But, strange as it may appear, while in every country, ancient and modern, serpents have been viewed with aversion, no other class of animals has furnished man with so many varied emblems,⁴ mythological⁵ symbols,⁶ and allegories.⁷ In Hindoo mythology the god Chrisna is sometimes represented entwined by a large cobra, which is fixing its poisoned fangs in the heel; and again the god is represented as crushing the head of the serpent, while he triumphantly tears the creature from his body—emblems which seem to spring from the great prophetic promise of Scripture, "It shall bruise thy head, and thou shalt bruise his heel."

* See Notes to Rules III. and IV.

5. In Grecian mythology snakes armed the hand of Discord; and both the Gorgons and the avenging Furies were represented with snakes wreathed around their heads instead of hair. As an emblem of prudence and circumspection, as well as from their reputed medicinal virtues, they were the attribute of Æsculapius, the father of medicine; entwined around the wand⁸ of Mercury, they were the type of insinuating eloquence; and from the venomous powers of many, they were used as the symbol of torment. Among the Egyptians the serpent was the emblem of fertility; while the circle formed by a snake biting its own tail—without beginning or end—was the chosen symbol of eternity.

6. The renowned Pythian games of Greece were fabled to have been established in commemoration of the slaying of the monster serpent Python by the arrows of Apollo. The slaying of the nine-headed Lernean hydra was the second of the twelve labors imposed upon Hercules. One of the most remarkable groups in sculpture which time has spared to us is "the Laocoon,"⁹ which represents the Apollonian priest, Laocoon, and his two sons, in the folds of two enormous serpents which had issued from the sea. The story is thus told by Virgil, as translated by Dryden:

7. "Then (dreadful to behold!) from sea we spied
Two serpents, rank'd abreast, the seas divide,
And smoothly sweep along the swelling tide.
Their flaming crests above the waves they show,
Their bodies seem to burn the seas below;
Their speckled tails they lash to urge their course,
And on the sounding shore the flying billows force.
And now the strand, and now the plain, they held.
Their ardent eyes with bloody streaks were fill'd;
Their nimble tongues they brandish'd as they came,
And lick'd their hissing jaws that sputter'd flame.

8. "We fled amazed: their destined way they take,
And to Laocoon⁹ and his children make:
And first around the tender boys they wind,
Then with their sharpen'd fangs their limbs and bodies grind.
The wretched father, running to their aid,
With pious haste, but vain, they next invade;
Twice round his waist their winding volumes roll'd;
And twice about his gasping throat they fold.
The priest thus doubly choked—their crests divide,
And tow'ring o'er his head in triumph ride.
With both his hands he labors at the knots;
His holy fillets¹⁰ the blue venom¹¹ blots:
His roaring fills the flitting air around.
Thus, when an ox receives a glancing wound,
He breaks his bands, the fatal altar flies,
And with loud bellowings breaks the yielding skies."

9. Among the Mexicans the serpent was the basis of their hideous and bloody religion. The supreme Mexican idol, Mexitli, was represented encircled and guarded by serpents, before which were offered human sacrifices.

"On a blue throne, with four huge silver snakes,
As if the keepers of the sanctuary,
Circled with stretching neck and fangs display'd,
Mexitli sat: another graven snake
Belted with scales of gold his monster bulk."

10. Even among our British ancestors the priests are said to have had tame serpents of great size, which they suffered to twine around their bodies, thereby inspiring the people with wonder, fear, and servile obedience. Southey, in his poem of *Madoc*, has vividly depicted such an exhibition and its effects. Neolin, the priest of the snake-god, is a prisoner in the hands of *Madoc* and his party, when

11. "Forth from the dark recesses of the cave
The serpent came: the Hoamen at the sight
Shouted; and they who held the priest, appall'd,
Relax'd their hold. On came the mighty snake,
And twined in many a wreath round Neolin,
Darting aright, aloft, his sinuous neck,
With searching eye and lifted jaw, and tongue
Quivering; and hiss as of a heavy shower
Upon the summer woods.

12. "The Britons stood
Astounded at the powerful reptile's bulk,
And that strange sight. His girth was as of man,
But easily could he have overtopped
Goliath's helmed head; or that huge king
Of Basan, hugest of the Anakim.
What then was human strength if once involved
Within those dreadful coils! The multitude
Fell prone, and worship'd."—SOUTHEY.

13. Thus much for the fable and poetry of our subject, which assuredly it is well to be acquainted with. A few words now as to the more tangible realities of serpent life. Serpents may be divided into the two large sections, the venomous and the non-venomous, of which about sixty species of the former have been enumerated, and more than three hundred of the latter.* They are numerous, and some of them of great size in the jungles, marshes, savannas,¹² and other desolate places of the tropics, but are rare and diminutive in cold regions. Only three species are found in Britain; none in Ireland; sixteen species are found in New York and the New England States, of which only two are venomous, the copperhead and the rattlesnake. All serpents are carnivorous, of slow growth, and long lived. Like all slow breathers, they can exist a long time without food.

14. Many thrilling accounts might be given of the serpent-charmers of the East; of deadly contests between serpents of different species, and between serpents and other animals,

* More correctly, the division is into VIPERINE and COLUBRINE serpents. In the former division are embraced the *Viper* family and the *Rattlesnake* family; in the latter, the *Coluber* serpents (our common harmless snakes), the *Boas* and *Pythons*, and the *marine* serpents. A few of the Colubrine serpents are believed to be venomous.

their natural enemies, and of the slaying of enormous boas and pythons of South America and Southern Asia, which have been known to envelop and crush in their folds a goat, deer, or ox, and even a man. Some of these accounts, which may be regarded as authentic, I will send for your perusal, and pass on in my next letter to a brief notice of the amphibians, the last of the four orders of the reptile race.

¹ DE-VOID', destitute of.

² MEM'-BERS, limbs of animal bodies.

³ EV-O-LŪ'-TIONS, motions.

⁴ ĒM'-BLEM, that which represents one thing to the eye and another to the understanding.

⁵ MYTH-O-LŌG'-IC-AL, pertaining to the fables of the heathen gods.

⁶ SŪM'-BOL, an emblem or sign of something.

⁷ ĀL'-LE-GO-RY, a story in which the literal meaning is not the direct or simple one.

⁸ WAND, a staff or rod of authority.

⁹ LĀ-ŌU'-Ō-ŪN.

¹⁰ FĪL'-LET, a head-band.

¹¹ VĒN'-OM.

¹² SA-VĀN'-NA, an open meadow or plain.

LESSON VII.—A LETTER ABOUT THE AMPHIBIANS.



THE AMPHIBIANS, OR BATRACHIANS.—1. The Proteus, or "Big Water Lizard," *Meno-branchus lateralis* (common in the waters of Western New York). 2. European Edible Frog, *Rana esculenta*. 3. Common American Frog, *Rana silvatica*. 4. Surinam Toad, *Pipa Americana*. 5. Southern Squirrel Tree-Toad, *Hyla Squirella*. 6. Crimson-spotted Triton, Evet, or Salamander, *Triton millepunctatus*. 7. Common European Water Newt, *Triton cristatus*. 8. Mexican Siren, or Azolot.

Dellwild, July 19th, 18—.

1. MY YOUNG FRIEND,—In beginning this promised letter, I must premise that the amphibians, called also, by some writers, *batrachians* (from a Greek word meaning a *frog*), have been

thought by some naturalists to possess peculiarities sufficiently important to entitle them to rank as a group distinct from the reptiles. Their arrangement, however, whether among the reptiles or as a distinct class, is unimportant, so long as we understand that, in descending from the higher to the lower forms of life, they hold a rank intermediate between the true reptiles and the fishes.

2. The chief interest connected with the amphibians, which comprise the frogs, toads, salamanders, and sirens, lies in the curious transformations¹ or metamorphoses¹ which they undergo, from the character of fishes in their infancy, breathing by means of gills, to the nature and habits of true reptiles, rising to the dignity of four legs, and breathing by means of lungs. Thus the common frog begins life as a *tadpole* or *pol-livog*, hatched from an egg in a pond or in some marshy place. In its fish-like state it continues for several weeks, breathes by means of gills, and feeds upon the vegetable food of fishes; at length the hinder legs bud, and are gradually developed; ere long the fore legs are produced in a similar manner; then gradually the tail shortens, dwindles away, and finally disappears; the gills are changed, lungs are formed, and the tadpole becomes a land animal. It has now risen to a higher life. Whereas it before swam by means of a tail, it now leaps by means of legs; and as before it ate only roots and grass, it now becomes a hunter of insects and worms.

3. Similar changes occur in all the amphibians, except that in a few of them, as in the sirens, the branchial organs² which project from the sides of the neck are permanent through life, and the animal breathes equally well in the water and on the land. In their full-grown state the habits of the amphibians are various. Thus the frogs, newts, many of the salamanders, and sirens pass most of their time in the slime of ponds, rivers, and ditches; others, like the toads, are essentially land animals. Some of the green frogs, which inhabit clear running streams, are extensively eaten in France, and considered a great delicacy.

4. The toads, although a harmless and inoffensive race, have had the misfortune to encounter the violent prejudice of mankind in all ages. A modern naturalist, writing upon this subject, says: "Yet if, with these prejudices to contend against, an observer of nature will have the courage to place one of these poor creatures in such a position as to examine its eye, his disgust or repugnance will be turned into pity and compassion; and he will wonder how such an expression

of mildness and patient endurance could beam from the eye of a being to which nature has given a form so repulsive, and which ignorance has invested with venomous³ malignancy.⁴ There is not, in fact, the least shadow of truth in these fabulous accounts of the venom of the toad, notwithstanding the authority of Shakspeare, and the day-dreams of the old naturalists."

5. Equally destitute of foundation is the notion that the salamander is the most venomous of animals. The Romans, who looked upon it with horror, had a proverb, that he who was bitten by a salamander had need of as many physicians as the animal had spots; and another more hopeless, "If a salamander bites you, put on a shroud." But the greatest absurdity was the belief that the salamander was incombustible—that it not only resisted the action of fire, but extinguished it: an idea which had no other foundation than the fact that its body is covered with warty glands, from which it emits, in time of danger, a milky fluid. Thus a very small fire might be extinguished by it.

6. The sirens, which are found only in North America, are the most singular of all the reptiles, as they have permanent branchial organs, which project from the sides of the neck, and can breathe equally well in the water and out of it. They may therefore be considered the only true amphibians. The siren of the Carolinas, found in the muddy water of the rice-swamps, is nearly two feet long, and has only two legs. The Mexican siren, or axolotl, has four legs. It is cooked like eels, and is regarded as a great delicacy. It was so plentiful when Cortez invaded Mexico that he is said to have subsisted his army upon it.

7. But I must bid adieu to my subject, and close this series of letters. If I have interested you, dispelled some prejudices, disposed you to look with more complacency upon this part of God's creation, and prepared you the better to appreciate the great whole of animated nature, the little time which both of us have given to this subject will not have been spent in vain. Had you passed this subject by, it would not only have been to you a link broken in the chain of animal life, but your future acquisitions in other allied sciences would thereby have been rendered incomplete and unsatisfactory.

¹ TRANS-FOR-MĀ'-TION, a met-a-morph'-o-sis, a change of form.

² BRANCH'-IAL, pertaining to the *branchiæ*, or gills.

³ VĒN'-OM-ous, spiteful, poisonous.

⁴ MA-LIG'-NAN-CY, extreme malice or hostility.

SECOND MISCELLANEOUS DIVISION.



LESSON I.—TO A GIRL IN HER THIRTEENTH YEAR.

1. Thy smiles, thy talk, thy aimless plays,
 So beautiful approve thee,
So winning light are all thy ways,
 I can not choose but love thee.
Thy balmy breath upon my brow
 Is like the summer air,
As o'er my cheek thou leanest now,
 To plant a soft kiss there.
2. Thy steps are dancing toward the bound
 Between the child and woman,
And thoughts and feelings more profound,
 And other years are coming :

And thou shalt be more deeply fair,
 More precious to the heart,
 But never canst thou be again
 That lovely thing thou art!

3. And youth shall pass, with all the brood
 Of fancy-fed affection;
 And grief shall come with womanhood,
 And waken cold reflection.
 Thou'lt learn to toil, and watch, and weep
 O'er pleasures unreturning,
 Like one who wakes from pleasant sleep
 Unto the cares of morning.
4. Nay, say not so! nor cloud the sun
 Of joyous expectation,
 Ordain'd to bless the little one,
 The freshling of creation!
 Nor doubt that he who thus doth feed
 Her early lamp with gladness,
 Will be her present help in need,
 Her comforter in sadness.
5. Smile on, then, little winsome thing!
 All rich in Nature's treasure,
 Thou hast within thy heart a spring
 Of self-renewing pleasure.
 Smile on, fair child, and take thy fill
 Of mirth, till time shall end it;
 'Tis Nature's wise and gentle will—
 And who shall reprehend it?—SIDNEY WALKER.

LESSON II.—THE LOVE OF COUNTRY.

WE can not honor our country with too deep a reverence; we can not love her with an affection too pure and fervent; we can not serve her with an energy of purpose or a faithfulness of zeal too steadfast and ardent. And what *is* our country? It is not the *East*, with her hills and her valleys, with her countless sails, and the rocky ramparts of her shores. It is not the *North*, with her thousand villages and her harvest-home, with her frontiers of the lake and the ocean. It is not the *West*, with her forest-sea and her inland isles, with her luxuriant expanses, clothed in the verdant corn; with her beautiful Ohio, and her verdant Missouri. Nor is it yet the *South*, opulent in the mimic snow of the cotton, in the rich plantations of the rustling cane, and in the golden robes of the rice-field. *What are these but the sister families of one greater, better, holier family, OUR COUNTRY?*—GRIMKE.

LESSON III.—A NOBLE REVENGE.

1. A YOUNG officer had so far forgotten himself, in a moment of irritation, as to strike a private soldier, full of personal dignity, and distinguished for his courage. The inexorable laws of military discipline forbade to the injured soldier any practical redress—he could look for no retaliation by acts. Words only were at his command, and, in a tumult of indignation, as he turned away, the soldier said to his officer that he would “make him repent it.” This, wearing the shape of a menace, naturally rekindled the officer’s anger, and intercepted any disposition which might be rising within him toward a sentiment of remorse; and thus the irritation between the two young men grew hotter than before.

2. Some weeks after this a partial action took place with the enemy. Suppose yourself a spectator, and looking down into a valley occupied by the two armies. They are facing each other, you see, in martial array. But it is no more than a skirmish which is going on; in the course of which, however, an occasion suddenly arises for a desperate service. A redoubt, which has fallen into the enemy’s hands, must be recaptured at any price, and under circumstances of all but hopeless difficulty.

3. A strong party has volunteered for the service; there is a cry for somebody to head them; you see a soldier step out from the ranks to assume this dangerous leadership; the party move rapidly forward; in a few minutes it is swallowed up from your eyes in clouds of smoke; for one half hour, from behind these clouds, you receive hieroglyphic reports of bloody strife—fierce repeating signals, flashes from the guns, rolling musketry, and exulting hurras advancing or receding, slackening or redoubling.

4. At length all is over; the redoubt has been recovered; that which was lost is found again; the jewel which had been made captive is ransomed with blood. Crimsoned with glorious gore, the wreck of the conquering party is relieved, and at liberty to return. From the river you see it ascending. The plume-crested officer in command rushes forward, with his left hand raising his hat in homage to the blackened fragments of what once was a flag, while with his right hand he seizes that of the leader, though not more than a private from the ranks. *That* perplexes you not; mystery you see none in *that*. For distinctions of order perish, ranks are confound-

ed; "high and low" are words without a meaning, and to wreck goes every notion or feeling that divides the noble from the noble, or the brave man from the brave.

5. But wherefore is it that now, when suddenly they wheel into mutual recognition, suddenly they pause? This soldier, this officer—who are they? O reader! once before they had stood face to face—the soldier that was struck, the officer that struck him. Once again they are meeting; and the gaze of armies is upon them. If for a moment a doubt divides them, in a moment the doubt has perished. One glance exchanged between them publishes the forgiveness that is sealed forever.

6. As one who recovers a brother whom he has accounted dead, the officer sprang forward, threw his arms around the neck of the soldier, and kissed him, as if he were some martyr glorified by that shadow of death from which he was returning; while, on his part, the soldier, stepping back, and carrying his hand through the beautiful motions of the military salute to a superior, makes this immortal answer—that answer which shut up forever the memory of the indignity offered to him, even for the last time alluding to it: "Sir," he said, "I told you before that I would make you repent it."

THOMAS DE QUINCEY.

LESSON IV.—HAMLET'S SOLILOQUY.

[Hamlet contemplates suicide to end his troubles, but is deterred by "the dread of something after death."]

To be', or not' to be? That is the question':
 Whether 'tis nobler in the mind, to suffer'
 The slings and arrows of outrageous fortune',
 Or to take arms against a sea of troubles,
 And, by opposing', end' them? To die'; to sleep';—
 Nô mōre;— and, by a sleep', to say we end
 The heart-ache', and the thousand natural shocks
 That flesh is heir to;— 'tis a consummation
 Devoutly to be wish'd. To die';— to sleep';—
 To sleep'! perchance to drēam;— Ay', there's the rub';
 For in that sleep of death what drēams may come',
 When we have shuffled off this mortal coil',
 Must give us pause. There's the respect
 That makes calamity of so long life':
 For who would bear the whips and scorns of time',
 The oppressor's wrong', the proud man's contumely',
 The pangs of despised love', the law's delay',
 The insolence of office', and the spurns
 That patient merit of the unworthy takes',
 When he himself might his quietus make

With a bare bodkin? Who would fardels bear,
 To groan and sweat under a weary life,
 But that the dread of something after death,
 That undiscover'd country, from whose bourn
 No traveler returns, puzzles the will,
 And makes us rather bear the ills we have,
 Than fly to others that we know not of?
 Thus conscience does make cowards of us all;
 And thus the native hue of resolution
 Is sicklied o'er with the pale cast of thought;
 And enterprises of great pith and moment,
 With this regard, their currents turn awry,
 And lose the name of action.—SHAKESPEARE.

LESSON V.—THE FOLLY OF CASTLE-BUILDING.

1. ALNAS'CHAR, says the fable, was a very idle fellow, who never would set his hand to any business during his father's life. His father, dying, left to him the value of a hundred drachmas in Persian money. Alnaschar, in order to make the best of it, laid it out in glasses, bottles, and the finest earthenware. These he piled up in a large open basket, and, having made choice of a very little shop, placed the basket at his feet, and leaned his back upon the wall, in expectation of customers. As he sat in this posture, with his eyes upon the basket, he fell into a most amusing train of thought, and was overheard by one of his neighbors, as he talked to himself. "This basket," says he, "cost me at the wholesale merchant's a hundred drachmas, which is all I have in the world.

2. "I shall quickly make two hundred of it by selling it in retail. These two hundred drachmas will in a little while rise to four hundred, which of course will amount in time to four thousand. Four thousand drachmas can not fail of making eight thousand. As soon as by this means I am master of ten thousand, I will lay aside my trade of a glass-man and turn jeweler. I shall then deal in diamonds, pearls, and all sorts of rich stones. When I have got together as much wealth as I can well desire, I will make a purchase of the finest house I can find. I shall then begin to enjoy myself and make a noise in the world. I will not, however, stop there, but still continue my traffic, till I have got together a hundred thousand drachmas.

3. "When I have thus made myself master of a hundred thousand drachmas, I shall naturally set myself on the footing of a prince, and will demand the Grand Vizier's daughter in marriage, after having represented to that minister the in-

formation which I have received of the beauty, wit, discretion, and other high qualities which his daughter possesses. I will let him know, at the same time, that it is my intention to make him a present of a thousand pieces of gold on our marriage night. As soon as I have married the Grand Vizier's daughter, I will make my father-in-law a visit with a grand train and equipage; and when I am placed at his right hand—where I shall be, of course, if it be only to honor his daughter—I will give him the thousand pieces of gold which I promised him, and afterward, to his great surprise, will present him another purse of the same value, with some short speech, as, 'Sir, you see I am a man of my word; I always give more than I promise.'

4. "When I have brought the princess to my house, I shall take particular care to keep her in a due respect for me. To this end, I shall confine her to her own apartment, make her a short visit, and talk but little to her. Her women will represent to me that she is inconsolable by reason of my unkindness, and beg me with tears to caress her, and let her sit down by me; but I shall still remain inexorable, and will turn my back upon her. Her mother will then come and bring her daughter to me, as I am seated upon my sofa. The daughter, with tears in her eyes, will fling herself at my feet, and beg of me to receive her into my favor. Then will I, to imprint in her a thorough veneration for my person, draw up my legs and spurn her from me with my foot, in such a manner that she shall fall down several paces from the sofa."

5. Alnaschar was entirely swallowed up in this chimerical vision, and could not forbear acting with his foot what he had in his thoughts. So that, unluckily striking his basket of brittle ware, which was the foundation of all his grandeur, he kicked his glasses to a great distance from him into the street, and broke them into ten thousand pieces.—ADDISON.

LESSON VI.—THE STRANGER AND HIS FRIEND.

Matt., xxv., 35.

1. A POOR wayfaring man of grief
Hath often crossed me on my way,
Who sued so humbly for relief
That I could never answer nay.
I had not power to ask his name,
Whither he went or whence he came;
Yet there was something in his eye
That won my love, I knew not why.

2. Once, when my scanty meal was spread,
 He entered—not a word he spake—
 Just perishing for want of bread.
 I gave him all; he blessed it, brake,
 And ate, but gave me part again;
 Mine was an angel's portion then,
 For while I fed with eager haste,
 The crust was manna to my taste.
3. I spied him where a fountain burst
 Clear from the rock; his strength was gone;
 The heedless water mocked his thirst;
 He heard it, saw it hurrying on—
 I ran, and raised the sufferer up;
 Twice from the stream he drained my cup,
 Dipp'd, and returned it running o'er;
 I drank, and never thirsted more.
4. 'Twas night. The floods were out; it blew
 A winter hurricane aloof;
 I heard his voice abroad, and flew
 To bid him welcome to my roof;
 I warmed, I clothed, I cheered my guest,
 I laid him on my couch to rest;
 Then made the ground my bed, and seemed
 In Eden's garden while I dreamed.
5. Stripp'd, wounded, beaten nigh to death,
 I found him by the highway side;
 I roused his pulse, brought back his breath,
 Revived his spirit, and supplied
 Wine, oil, refreshment. He was healed.
 I had myself a wound concealed,
 But from that hour forgot the smart,
 And peace bound up my broken heart.
6. In prison I saw him next, condemned
 To meet a traitor's doom at morn;
 The tide of lying tongues I stemmed,
 And honored him, midst shame and scorn.
 My friendship's utmost zeal to try,
 He asked if I for him would die:
 The flesh was weak, my blood ran chill,
 But the free spirit cried "I will."
7. Then in a moment to my view
 The stranger started from disguise;
 The tokens in his hands I knew—
 My Savior stood before my eyes.
 He spake, and my poor name he named—
 "Of me thou hast not been ashamed;
 These deeds shall thy memorial be;
 Fear not, thou didst them unto me."—MONTGOMERY.

LESSON VII.—SCENE BETWEEN BRUTUS AND CASSIUS.

Cas. Must I endure all this'?

Bru. All this' ? ay', more' : Fret till your proud heart break ;
Go show your *slaves* how cholerick' you are',
And make your *bondmen* tremble. Must I budge' ?
Must I observe you' ? must I stand and crouch
Under your testy humor' ? By the gods',
You shall digest the venom of your spleen,
Though it do split' you ; for, from this day forth',
I'll use you for my mirth, yea, for my laughter,
When you are waspish.

Cas. Is it come to this' ?

Bru. You say you are a *better*' soldier :
Let it appear' so ; make your vaunting true',
And it shall please me well' : For mine own part',
I shall be glad to learn of noble' men'.

Cas. You wrong' me every' way ; you wrong' me, Brutus' :
I said an elder' soldier, *not* a better' :
Did I say better' ?

Bru. If you did', I care not'.

Cas. When Cæsar lived, he durst not thus have moved me.

Bru. Peace, peace ; you durst not so have tempted him.

Cas. I durst not' ?

Bru. No.

Cas. What ! durst not tempt him' ?

Bru. For your life' you durst not.

Cas. Do not presume too much upon my love' ;
I may' do that I shall be sorry' for.

Bru. You *have*' done that you *should* be sorry' for'.

There is no terror', Cassius', in your threats' ;
For I am arm'd so strong in honesty',
That they pass by me as the idle' wind',
Which I respect' not. I *did* send to you
For certain sums of gold', which you denied' me—
For I can raise no money by vile means ;
—I had rather coin my heart',

And drop my blood' for drachmas, than to wring
From the hard hands of peasants their vile trash
By any indirection. I *did* send

To you for gold to pay my legions',
Which you denied me : Was that done like *Cassius*' ?
Should I have answered Caius Cassius so' ?

When Marcus Brutus' grows so covetous,
To lock such rascal counters from his friends',
Be ready, gods, with all your thunderbolts,
Dash' him to pieces !

SHAKSPEARE.

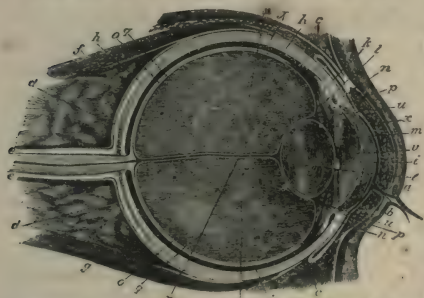
PART III.

SECOND DIVISION OF HUMAN PHYSIOLOGY AND HEALTH.

(This subject is continued from the Fourth Reader.)

Fig. 1.

SIDE VIEW OF A VERTICAL SECTION OF THE EYE.



The eyelids are here closed: *a*, upper eyelid; *b*, lower eyelid; *i*, transparent cornea, immediately beneath the eyelid; *v*, anterior chamber of the aqueous humor; *x*, posterior chamber of the aqueous humor; *m*, the iris, with its circular opening called "the pupil," in the direction toward which *v* is pointing; *t*, the crystalline humor or lens; *s, s*, the vitreous humor; *e, e*, between these passes the optic nerve; *o, o*, the retina, which is an expansion of the optic nerve spreading over the vitreous humor. The retina is considered the inner coat of the eye. Next outward of this is *j, j*, the choroid coat, of a dark color, and filled with minute branches of blood-vessels. Adjoining this is *h, h*, the sclerotic coat, or white of the eye, into which the cornea fits like a watch-glass into its case; *r*, capsular artery.

of the eye, into which the cornea fits like a watch-glass

LESSON I.—THE WINDOW OF THE SOUL.

1. THE EYE has been appropriately called the "window of the soul." It opens to us, by its wonderful mechanism, a world of beauty, enabling us to perceive the form, color, size, and position of surrounding objects; and it probably contributes more to the enjoyment and happiness of man than any other of the organs through which mind holds communion with the external world.

2. A general knowledge of its structure and action, as a living instrument of vision, may be gathered from the drawing above, by the aid of a brief description. The eyelids—the shutters to this window—which open and close to admit or exclude the light, stand also as watchful guardians to protect the instrument from danger; and by their involuntary action the hard and transparent *cornea* at the front of the eye is kept constantly lubricated,¹ and free from dust.

3. Back of this cornea is a chamber containing the *aqueous*, or watery humor;² and suspended in this is a circular curtain, the colored *iris*, which has the power of contracting and dilating, to regulate the quantity of light that enters the round

opening in its centre, called the *pupil*. Immediately back of the pupil is the *crystalline*³ lens, composed of numerous layers or coatings, which increase in density toward the centre; an arrangement which prevents that spherical aberration, or too great dispersion of the rays of light, which it has been found so difficult to overcome in artificial lenses. Back of the crystalline lens, and filling a large part of the cavity of the eye, is the *vitreous*, or glassy humor, and spread over this is the thin and delicate membrane of the *retina*,⁴ which is the expansion of the optic nerve.

4. It is on the retina, where it concentrates at the back part of the ball to form the optic nerve, that the images of objects at which the eye looks, whether near or distant, are beautifully pictured or daguerreotyped. We can not look without wonder upon the smallness yet correctness of these pictures. Thus a landscape of several miles in extent is brought into the space of a sixpence, yet the objects which it contains are all distinctly portrayed in their relative magnitudes, positions, figures, and colors, with a fineness and delicacy of touch to which art can make no approach.

5. Yet the mechanical part of this apparatus—its beautiful structure, its perfect adaptation to the laws of light, and its ready adjustment to meet the ever-varying degrees of light, and shade, and distance—are far less wonderful than the mental or spiritual part, the manner in which the pictures on the retina are made known to the mind or soul within, through the medium of the optic nerve. The former is a mechanical wonder, of which we comprehend sufficient to excite our unbounded admiration; the latter is a spiritual mystery, of which we know nothing but the bare fact itself.

6. Mr. Addison, in a number of the *Spectator*, has drawn a much-admired picture of the sense of sight, in the introduction to the first of his celebrated *Essays on the Pleasures of the Imagination*. We select the opening passages, which Mr. Blair so highly commends for their rhetorical grace and beauty.

7. "Our sight is the most perfect and most delightful of all our senses. It fills the mind with the largest variety of ideas, converses with its objects at the greatest distance, and continues the longest in action without being tired or satiated with its proper enjoyments.

8. "The sense of feeling can indeed give us the idea of extension, figure, and all the other properties of matter which are perceived by the eye except colors; but, at the same time, it is very much straitened and confined in its operations with regard to the number, bulk, and distance of its objects.

9. "Our sight seems designed to supply all these defects, and may be considered as a more delicate and diffusive kind of touch, that spreads it-

self over an infinite multitude of bodies, comprehends the largest figures, and brings into our reach some of the most remote parts of the universe.

10. "It is this sense which furnishes the imagination with its ideas: and by the pleasures of the imagination or fancy (terms which I shall use promiscuously) I here mean such as arise from visible objects, either when we have them actually in our view, or when we call up their ideas in our minds by paintings, statues, descriptions, or other similar means.

11. "We can not, indeed, have a single image in the fancy that did not make its first entrance through the sight; but we have the power of retaining, altering, and compounding those images which we have once received, and of forming them into all the varieties of picture and vision that are most agreeable to the imagination; for, by this faculty, a man in a dungeon is capable of entertaining himself with scenes and landscapes more beautiful than any that can be found in the whole compass of nature."

¹ LŪ'-BEI-CĀ-TED, made smooth or slippery³ CRŶS'-TAL-LĪNE, clear; resembling crystal.
by moisture.

² HĪ'-MOE, (yū'-mor, or hū'-mor).

⁴ RĒT'-I-NA, plural rēt'-i-na.

LESSON II.—THE LIVING TEMPLE.¹

OLIVER WENDELL HOLMES.

1. NOT in the world of light alone,
Where God has built his blazing throne',
Nor yet alone in earth below,
With belted seas that come and go',
And endless isles of sunlit green,
Is *all* thy Maker's glory seen':
Look in upon thy wondrous frame',—
Eternal wisdom still the same'!
2. The smooth, soft air, with pulse-like waves,
Flows murmuring through its hidden caves,²
Whose streams of brightening purple rush,
Fired with a new and livelier blush,³
While all their burden of decay
The ebbing current steals away';⁴
And red with Nature's flame they start
From the warm fountains of the heart.
3. No rest that throbbing slave⁵ may ask,
Forever quivering o'er his task,
While far and wide a crimson jet
Leaps forth to fill the woven net,⁶
Which in unnumbered crossing tides
The flood of burning life divides;
Then, kindling each decaying part,⁷
Creeps back to find the throbbing heart.
4. But, warmed with that unchanging flame,⁸
Behold the outward moving frame';
Its living marbles jointed strong
With glistening band and silvery thong,⁹

And linked to reason's guiding reins¹⁰
 By myriad rings¹¹ in trembling chains,
 Each graven with the threaded zone¹²
 Which claims it as the Master's own.

5. See how yon beam of seeming white
 Is braided out of seven-hued light;¹³
 Yet in those lucid globes¹⁴ no ray
 By any chance shall break astray.
 Hark how the rolling surge¹⁵ of sound,
 Arches and spirals circling round,
 Wakes the hushed spirit through thine ear
 With music it is heaven to hear.
6. Then mark the cloven sphere¹⁶ that holds
 All thought in its mysterious folds;
 That feels sensation's¹⁷ faintest thrill,
 And flashes¹⁸ forth the sovereign will;
 Think on the stormy world that dwells
 Locked in its dim and clustering cells!¹⁹
 The lightning gleams of power it sheds
 Along its hollow glassy threads!²⁰
7. O Father! grant thy love divine
 To make these mystic temples thine!
 When wasting age and wearying strife
 Have sapped the leaning walls of life,
 When darkness gathers over all,
 And the last tottering pillars fall,
 Take the poor dust thy mercy warms,
 And mould it into heavenly forms!

[A full explanation of the foregoing exquisitely beautiful verses would lead to a general review of the entire subject of Physiology. Every pupil should give *as much* explanation, at least, as is contained in the following notes.]

¹ The human frame.

² The air-cells of the lungs.

³ The blood, by being purified in the lungs, is changed from a dark purple to a light crimson hue. See Fourth Reader, p. 48.

⁴ "Ebbing current"—the expired air. A great portion of the decayed and worn-out particles of the body are thrown out from the lungs in the form of carbonic acid and vapor. See Fourth Reader, p. 50.

⁵ The heart. See Fourth Reader, p. 51.

⁶ "Woven net"—the net-work of veins and capillaries. See Fourth Reader, p. 51 and 60.

⁷ The blood supplies new material to all parts of the body, and bears back to the lungs the decaying and worn-out particles.

⁸ The warm blood is often spoken of as the *flame* of life.

⁹ Tendons, cords, and sinews knit the "marbles," or bony frame-work strongly together, as with *thongs*.

¹⁰ The frame-work of the body is linked to the "guiding reins," or the mind, by those "trembling chains," the nerve tubes, or nerve fibres. See page 90.

¹¹ All the tissues of the body are formed primarily of *cells*. Cells, opening, form rings; and these rings unite, in certain cases, to form nerve fibres. Hence these nerve fibres may well be described as "myriad rings in trembling chains."

¹² The "threaded zone," or hollow of each nerve fibre, contains a fluid substance like that found in the brain itself.

¹³ The "seeming white" light is made up of the seven primary colors, *red, orange, yellow, green, blue, indigo, and violet*.

¹⁴ The balls of the eye, through whose humors the rays of light pass to the retina.

¹⁵ The air, whose vibrations in the chambers of the ear give the sensation which we call *sound*.

- ¹⁶ "Cloven sphere"—the two hemispheres of the brain; the seat of "all thought." See p. 89.
¹⁷ That receives impressions through the "nerves of feeling," or *sensory* nerves. See p. 91.
¹⁸ That sends forth its commands through the *motor* nerves. See p. 90.
¹⁹ The nerve-cells, forming the gray substance of the brain. See p. 92.
²⁰ "Glassy threads"—the nerve threads or nerve fibres.

LESSON III.—THE BRAIN: THE NERVES OF VOLUNTARY MOTION AND THE NERVES OF FEELING.

1. IN that part of the Fourth Reader which was devoted to "Human Physiology and Health," we treated of the bones', and the injuries to which they are liable'; of the muscles', and the laws of their healthy action'; of the organs that prepare nourishment for the body', their proper treatment', and the variety of ways in which we too often abuse' them; of the organs of circulation and of respiration, and their mysterious workings'; of the skin, its uses and abuses, and its complicated mechanism'; of the phenomena of growth and decay, of life and death'; and generally' of the laws of health which depend upon the harmonious action of all the bodily organs. The functions of which we treated were those chiefly of *organic* life, which, to a certain extent, are common to both plants and animals; for both live and grow, decay and die, through organic processes that are essentially alike. As we have before stated, the microscope has shown, in a most striking manner, that vegetables and animals are alike constructed of *cells*.

2. But the parts and functions which we have described are, in all animals, subordinate to the NERVOUS SYSTEM, the higher department of animal physiology, to the study of which we shall devote several of the lessons in the present Part of this volume. It is through this system that all governing power is exerted in the body'; that the muscles are made to move', and the blood to flow'; that respiration and digestion are carried on'; that growth is regulated', and every action directed in the thousand mysterious processes of life'; and it is through the same channel also that the mind derives sensations and perceptions from, and holds communion with, the external world. It is also found that, throughout all animal life, from the lowest grades up to the highest, the degree of intelligence bears a close relation to the degree of development of the nervous system.

3. What, then, *is* this nervous system in man, that ranks so

high above every other in the body as to be the direct agent on which all the functions of life depend, and which, in our mortal state, is the immediate minister and messenger of the mind, and of the principle of life itself? It is a brief and easy answer to say that this nervous system consists of all the *nerves* in the body, of which the chief bundles or masses are the brain, and the spinal marrow, and several other small nervous bundles called *ganglia*. But to explain the functions of these is a more complicated matter; and their study will be found to have an intimate connection with the study of mind itself, or mental philosophy.*

4. The brain is that large organized mass which, with its enveloping membranes, completely fills the cavity of the skull. It is divided vertically nearly into two halves by a deep fissure or cleft, as is seen in the illustration, Fig. 2, given below; and its surface is singularly roughened by elevations and depressions, which have the appearance of folds closely crowded upon each other. The chief mass of the brain is called the *cerebrum*,¹ or great brain; below, and somewhat back of this, is the *cerebellum*,² or little brain; and connected with and proceeding from both is the spinal cord, or spinal marrow, which extends downward through the spinal column or

Fig. 2.
UPPER SURFACE OF THE BRAIN.

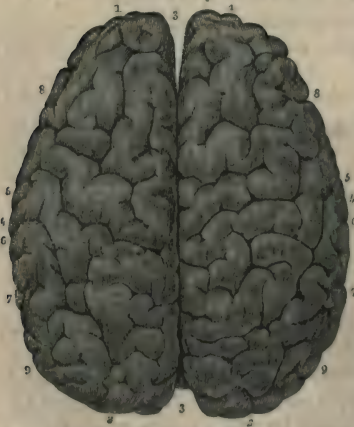


Fig. 2. This engraving represents the appearance of the upper surface of the brain, after its covering, the skull, has been removed. The figures 1, 1, show the anterior or front lobes, and 2, 2, the posterior lobes; while from 3 to 3 extends what is called the great median fissure, which divides the brain into two hemispheres, or halves. The figures 5, 5, point to what are called the anterior parietal convolutions; 6, 6, to the posterior; 7, 7, to the rudimentary; 8, 8, to the frontal convolutions; and 9, 9, to the occipital. Not only is the brain a *double* organ, sending forth its nerves by pairs, but the same symmetrical doubleness is continued throughout the whole nervous system. It is believed that each half of the brain can act separately, but that both can best act simultaneously.

"While it is true that any unusual and healthy development of brain is attended with correspondingly increased mental powers, yet in this we must not overlook the merely *instrumental* nature of the organ. Though imperfections in it may produce a manifest inferiority, that inferiority is by no means to be referred to the intellectual principle itself. The mode of action being by an instrument, the mode of action becomes imperfect too."—DRAPER.

if that instrument becomes imperfect the action becomes imperfect too."—DRAPER.

* The subject of Mental Philosophy will be taken up in the Sixth Reader.

back-bone. In the engraving at the foot of page 91 is represented an internal side view of the right half of the brain.

5. The brain is composed of a soft jelly-like substance, very much like the marrow which is found in bones. The interior portion, which is of a white color, is composed of exceedingly minute tubes, which are the beginnings of the nerves. These little nerve tubes are exceedingly minute; but where they start from the brain a bundle of them is generally inclosed in a sheath; then this bundle is divided and subdivided, branching out in smaller and smaller divisions, until each little nerve tube is connected with some one muscular fibre or some one sensitive point in the body. Each of these little tubes, although sometimes too small to be distinctly seen by the microscope, is supposed to be entirely separate from its fellow nerves, and unconnected with them from its beginning to its termination.

6. We will now explain the uses of these little nerve tubes, of which there are millions in the body, and we will do it by supposing a particular case in which they are used. If the mind wishes to move the right hand it sends a message downward from the brain along the course of the spinal cord in the neck, and thence down along the arm through a bundle of the nerves that run to the hand. If the mind wishes the

Fig. 3.
BASE OF THE BRAIN.

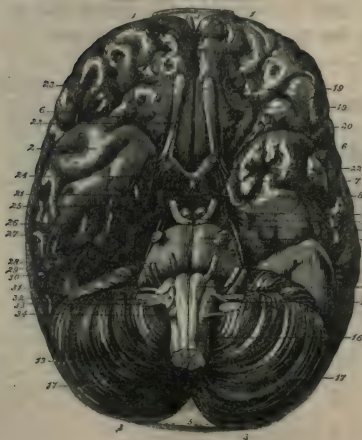


Fig. 3 represents the base of the brain as seen from below, together with some of the double sets of nerves branching from it. Here the figures 1, 1, represent the anterior or front lobes, and 3, 3, the lobes of the cerebellum, which lies at the base of the back part of the skull. From 4 to 18 is the line of the median fissure. Figure 13 points to the medulla oblongata, or severed portion of the upper part of the spinal marrow; 22, to one of the olfactory nerves, or nerves of smell; 24, to the beginning of the pair of optic nerves, or nerves of sight; while 25 and 28 point to one, each, of pairs of oculomotor nerves, or nerves that direct the motions of the eyes; 27 and 29 to nerves that move the muscles of the face, and 30 to the auditory nerves, or nerves of hearing. The *doubleness* of the nerves is here well illustrated; and this is the characteristic of the whole nervous system, the cranial and spinal nerves coming forth *by pairs* to their distribution on the right and left sides of the body. The object of this arrangement is evidently to increase the *precision* of nervous action, and to compensate readily for any incidental defects.

whole hand to move, it sends the message through all the nerves that run there, and one tells the little finger, another the fore-finger, and another the thumb, etc., what to do. If the mind wishes the fingers to strike the keys of the piano, it tells each finger, through its own nerves, what key to strike. These nerves, through which the mind sends out its commands to the fingers, and to every muscle in every part of the body, telling each when and how to act, are called *motor nerves*, or nerves of motion. If the bundle of motor nerves running to the hand should be cut in two, the hand would not move! And why? Because it could receive no command from the brain; and it will not move without orders from *head-quarters*.

7. But there is another set of nerves running to the hand besides the nerves of motion. What if the fore-finger had been directed, in the dark, to touch a certain key of the piano, and had chanced to press upon the sharp point of a needle or the blade of a knife! How could the mind be informed of the danger? Not by the nerves of *motion*, for their only office is to convey commands outward from the brain. Another set of nerves is needed, and such has been provided in the *nerves of feeling*. As soon as the finger presses upon the needle's point, some of these numerous and minute nerves of feeling are pierced, and instantaneously they convey the intelligence to the brain. As quick as thought, a command is then sent down, through the nerves of motion, to withdraw the finger, if possible, before any serious injury is received. If the bundle of nerves of feeling running to the hand should be severed, the finger might be pierced through, or cut off,

Fig. 4.
EXTERNAL SIDE VIEW OF THE BRAIN.

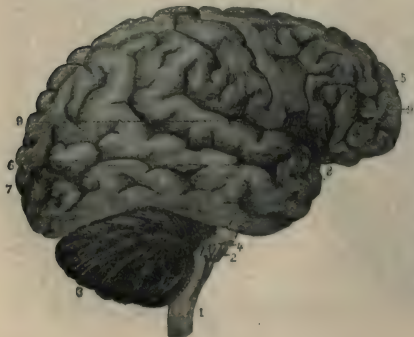


Fig. 4 represents an external side view of the right half of the brain. At 1 is seen the medulla oblongata, or beginning of the spinal marrow; at 3, a side view of the *cerebellum*, or little brain. The chief office of the cerebellum is believed to be that of combining, regulating, and directing all the muscular movements. From experiments on animals, it is found that when it is cut it gives rise to neither motion nor sensation, but when it is removed in slices the animal gradually loses all power of *regulating* its motions. The weight of the cerebellum is about one eighth of that of the cerebrum. The average weight of the entire brain in man is about fifty ounces; in females about forty-five.

and the mind have no knowledge of it! And why? Because no notice of the injury could be sent from the finger up to the brain.

8. The following fact illustrates the use of the nerves of feeling in preventing injury. A man who had lost all sensibility in the right hand, on account of an injury to the bundle of nerves of feeling, while the nerves of motion were still perfect, lifted the cover of a pan when it was burning hot. Although he could feel no pain, the consequence was the loss of the skin of the fingers and of the palm of the hand, laying bare the muscles and tendons. If the nerves of feeling had not been injured, the warning of pain would have been instantly given to the brain, and orders would have been sent to the muscles to relax their grasp of the cover; and so rapid would have been these messages, through the nerves of feeling, to the brain, and back through the nerves of motion, that the cover would have been dropped soon enough to prevent any great amount of injury from being done.

9. In the foregoing explanation we have a general view of the functions of the nervous system, which consists, principally, of the brain and the spinal marrow, and numerous sets of two kinds of nerves running from them to all parts of the body. The nerves of feeling and the nerves of motion are, so far as we can discover, the same in structure and in composition; but as the offices which they perform are entirely

Fig. 5.
INTERNAL SIDE VIEW OF THE BRAIN.



Fig. 5 represents an *internal* side view of the right half of the brain — the brain being cut or split downward from the white body in the centre. At 1 is shown the half of the medulla oblongata; 4 points to what is called the *arbor vitæ*, or "tree of life," of the cerebellum; 20 points to the origin of one of the nerves that move the eyes; and 21 to the origin of the optic nerve, which is seen proceeding toward the eye; 26 points to what here appears as a crescent-shaped white substance, called the corpus callosum. It appears to be the peculiar office of the cerebellum to direct, combine, and control muscular motions; and those animals which have it the most fully developed excel in their powers of motion, and are distinguished by the complication of their movements. If removed by degrees, in successive slices, the motions of the ani-

mal become irregular, and, finally, it loses all power of walking or of maintaining its equilibrium.

different, there is something about them which we do not yet understand. Nor can we understand *how* the mind receives impressions through one set, and sends out messages and causes motion through another, for this would be to understand *how* mind acts upon matter, and *how* the spiritual is connected with the material world.

10. But there is one thing more about the brain which we may explain here. We have said that the central part of it is of a white color, and composed of the beginnings of the minute nerve tubes which we have described. But all around this white inner part is a thick layer of gray substance, thickly lining the interior of all the convolutions or folds of the brain; and this gray substance is composed of minute *cells*, intermingled with which are exceedingly minute and numerous blood-vessels, which supply the cells with their requisite nourishment. This cellular substance of the brain is acknowledged by physiologists to be the seat or dwelling-place of the mind—of the intellect itself; and the mind—the ruling power within us—is believed to act directly upon this gray matter, while the white substance serves only to transmit messages to the muscular fibres, and bring back impressions. It is found, in examining the brains of animals, that, the greater the intelligence, the more abundant is the gray substance; and in man it is especially abundant, constituting much the largest proportion of the brain.

1 CĚR'-E-BRUM.

2 CĚR-E-BĚL'-LUM.

Fig. 6.

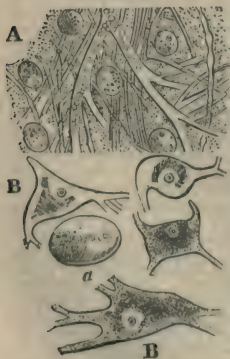


Fig. 6. At A is represented a collection of nerve-cells, nerve fibres, and blood-vessels from the human brain, greatly magnified. This is from that part of the brain called the optic thalamus. At *a* is shown one of these nerve-cells still more highly magnified. The branching tube in A is a blood-vessel showing the circular blood-cells floating in it. (See Fourth Reader, p. 32.) At B, B are represented some of the nerve-cells found in the gray substance of the brain. These cells, which have a nucleus, or central particle, are originally globular, but many often assume various shapes, and often shoot out in branches. While the nervous *fibres* conduct external impressions to the brain, and transmit nervous influences from it, the nerve-cells are supposed to be the various centres which receive the impressions and originate the nervous influences, under the directing power of the mental principle. A collection or bundle of these cells is called a *rescicle*, which may be regarded as a temporary magazine of nervous power, with its many cell-like divisions, each of which has some particular duty to perform. Thus the form of the large cell at B (highly magnified) would indicate that it may receive nervous influence from two directions, and then transmit it, as occasion demands, in four or five directions.

LESSON IV.—OTHER FORMS OF NERVOUS ACTION.

1. IN the preceding lesson we contemplated nervous action in only two of its forms—as producing sensation and voluntary motion, in which the mind is the recipient in one case, and the active agent in the other. But much of the muscular motion of the body is produced without the agency of the will or mind, and sometimes even in opposition to it. It would not answer to intrust the circulation of the blood, and the acts of breathing and digestion, to the control of the mind; for the mind might slumber or be forgetful; or the brain, which is its organ, might be diseased, and then the pulsations of the heart would stop, the lungs and the stomach would cease their labors, and the body would die. But by a most wonderful provision the heart beats on, even when the mind takes no notice of it; and the stomach performs the labor of digestion, and the lungs that of respiration, independently of the will. By what agency, then, is it that these and many other involuntary motions are produced? The answer to this question will open a new view of the wonders of the nervous system.

2. We have stated that the spinal marrow, proceeding from the brain, extends downward through the spinal column or back-bone. Its substance and structure are similar to those of the brain, except that the nervous tubes—the white matter—compose the outer portions of it, and the gray cellular matter the inner parts. Along the outer portion run the two kinds of nerves from the brain, those of motion and those of feeling, branching off here and there to various parts of the body.* But, in addition to these nerves which it transmits along its channel, the spinal marrow sends off nerves of its own to the heart, lungs, stomach, etc., and other internal organs. It has long been known that all the nerves from the spinal marrow are sent off in pairs through the two furrows on each side of the back-bone, and that each pair has two roots, one root coming from the back portion, and the other from the front. These two roots unite as soon as they have fairly left the spinal cord, after which their fibres branch off to the several places of their destination.

* Whether these nerves are continuous all the way from the brain, as was formerly supposed, or not, is now doubted. If not, impressions must be transmitted from the brain first to the cellular substance of the spinal marrow, and then sent forward by some nervous force which has been stored up in the spinal marrow for this purpose. Impressions would be returned from the lower extremities to the brain in the same way.

Fig. 7.*



3. It is one of the great discoveries of physiology that the anterior root of each pair contains only nerves of motion, and the posterior root only nerves of sensation, and that the former, therefore, carry impressions or commands *from* the spinal marrow, and the latter bring impressions *to* it.† But what is peculiar to some of these nerves is, that when they run to the heart, lungs, etc., they act independently of the brain. Thus, when the right ventricle of the heart is filled with the dark impure venous blood, the nerves of sensation which run to the heart convey a notice of the fact to the gray substance of the spinal marrow; this gray substance, which seems to have a power in itself independent of the brain, responds to this notice, and sends back a message to the heart by the motor nerves, directing the muscles of the right ventricle to contract, and force the blood into the lungs, that it may be purified there. It is the same with all the other involuntary muscles—with those of the lungs and the stomach; they are put in motion at the proper time, and in the right manner, through the medium of nerves over which, ordinarily, the will has no control.

4. The exceeding wisdom of an arrangement by which the functions of the heart and lungs are continued in unceasing operation, without the necessity of mental control, is so obvious that we need not dwell upon it. The nervous power that controls them seems to be stored up in the gray cellular substance of the spinal marrow, just as the power that moves the wheels and hands of a watch is stored up in the coil of the main-spring. In winding up the watch we use a certain amount of *force*, and this force we transmit to the main-spring, where it remains coiled up, to be given off as needed in moving the wheels and hands of the watch. So, when this infinitely more perfect machine of the muscles of involuntary motion, made by the Great Architect, is kept properly wound up by a due supply of appropriate nourishment and pure air, and by a due observance of all the other conditions of healthy action, it continues in motion until the power stored up in it

* This is a side view of the *left side* of the spinal cord.

† Fig. 7 shows a portion of the spinal cord surrounded by its envelopes, and showing the origin of the anterior and posterior roots. Thus, at 1, 1 are shown the posterior roots of the spinal nerves, and 2, 2, the anterior roots of the same nerves; at 3, 4, and below them, the anterior and posterior roots are cut. In the upper portion of the engraving the sheath or envelope of the spinal cord is preserved; and at 6 are shown the two roots united, and projecting from the sheath; and at 7 is shown a vertical section of the two roots cut close to the sheath, and showing the vertical line which divides one root from the other.

has been exhausted. It has been left to us to avail ourselves of the proper means of continuing for a while a supply of this force, although we can not originate it; and judicious care will enable us for a long time to keep the machine of life in motion, although it will finally wear out.

5. We have said that *ordinarily* the will has no control over the nerves connected with the involuntary muscles—receiving no sensations from them, and conveying no messages to them. But Infinite Wisdom, which plans all things well, has made some exceptions here. Ordinarily the action of the lungs in respiration is wholly unnoticed by the mind; but when there is embarrassment in the lungs, occasioned, for example, by the presence of some irritating substance, or by disease, the quiet process carried on by the agency of the spinal marrow alone is not adequate to meet the exigency. The act of breathing is now accompanied with positive sensations which the brain takes notice of, that the individual may, if possible, provide a remedy. By a mental effort the will can quicken the action of the lungs, if necessary. Not so, however, with the movements of the stomach in digestion; no effort of the will can quicken or retard the action of this muscle. The will can not directly influence the motions of the heart, though it can do it indirectly by so directing the thoughts as to awaken emotions calculated to produce this effect.

6. Thus it has been seen, in the mysteries of the nervous system, that there are two kinds of nerves of common sensation, one conveying impressions to the brain, and the other kind transmitting impressions that are unnoticed by the mind to other centres of nervous power and influence. It has been seen, also, that there are, corresponding to these, two different kinds of nerves of motion, one acting under mental control, and the other not. Still another important principle of nervous influence we have to notice in this connection, and that is, that there are different nerves for different *kinds* of sensation. The nerves of *feeling* are spread all over and throughout the body; but, in addition to these, there are nerves of *hearing*, *seeing*, *smelling*, and *tasting*, each entirely different in its functions from all the others.

7. Thus the nerves of *hearing* convey to the mind impressions that we call *sound*; the optic nerve transmits impressions of another kind, and the nerves of smelling and tasting impressions of still different kinds. Each kind has its own duty to perform, and it can perform no other. Thus the optic nerve, which is only subject to the influence of light, can con-

vey no impression of hearing, nor of smelling, nor of tasting; nor can it convey any impression of pain. If the eye be injured, a nerve of ordinary sensation is required to convey the intelligence to the mind. So in the nose; the nerve that takes notice of odors is a different one from that by which irritation on the same membrane is felt. The snuff-taker smells the snuff with one nerve, and *feels* its tingling with another.

8. Thus we have briefly explained the leading parts and principles of action of the Nervous System. In one part of this system we have found one set of nerves—the nerves of *feeling*, as they are called, whose office is to convey to the mind impressions of ordinary sensation from the surrounding world; and a still different set, called nerves of *motion*, to convey the commands of the mind to the numerous voluntary muscles. In another part of this system we have also found two sets of nerves, but different from the former, running to and from the involuntary muscles, and regulating their motions. And we have also found still different nerves, sometimes called nerves of *special* sense, conveying to the mind those impressions which give us a knowledge of the objects of taste and of sounds, of shades and colors, and of odors. Some mysterious power presides over all of them, and keeps them in harmonious action, until accident, or disease, or age seriously mars the beautiful mechanism, and then we die. No, not *we*! It is only the body—the machine that is broken or that is worn out, while *we*, the spirit-mind, shall exist forever.

LESSON V.—SPIRIT, THE MOTIVE POWER OF THE BODY.

1. A machine is a combination of parts composed of material substances, solid or fluid, or both, as the case may be; it possesses not its own principle of motion; it can not urge its own levers,¹ or stretch its own cords, or turn its own wheels, or put its own fluids into circulation. The efficient cause of its motion, which is altogether distinct from the machine itself, is called the prime mover.

2. The point on which I desire now to fix your attention is, that this prime mover is altogether distinct from the machine, and independent of it; that it possesses, or at least may possess, no property in common with it; and that its existence or non-existence is not decided by the existence or non-existence of the machine.

3. The machine may be broken, destroyed, worn by age, or otherwise disabled, and yet the prime mover may still retain its original energy. Thus a steam-engine is moved by fire, a mill by wind or water; the steam-engine may be worn out, and the mill be broken by accident; and yet the fire, and the wind, and the water will still preserve their powers.

4. These observations, which correctly describe a machine, may with propriety be applied to the human body. This body is also a combination of parts, composed of material substances, solid and fluid, having certain definite forms and arrangements, possessing certain capabilities of motion and force, destined and admirably adapted to obey the dictation of its prime mover, the living principle, the immaterial spirit.

5. So long as it pleases the Great Engineer who constructed this body to permit its connection with that intellectual spirit, so long will it obey the impulses which it receives; nor does the decay in this bodily machine infer any corresponding decay of the moving spirit any more than the wear and tear of a steam-engine proves the destruction of the principle of heat which gives it motion.

6. Neither are we to infer, because this bodily machine, in its obedience to the vital spirit, acts mechanically, and is adapted to all the ordinary properties and laws of matter, that therefore the spirit which moves it partakes of the nature of matter, or is answerable to its laws, any more than we should infer that the levers, wheels, pumps, chains, cords, and valves of a steam-engine are regulated by the laws which govern heat. On the contrary, I submit it to the candor of the most skeptical² materialist³ whether the whole tendency of analogy⁴ does not directly overthrow the hypothesis⁵ that the principle of life is organic.⁶

7. We are assured in the Scriptures that in the first instance "God formed man of the dust of the ground;" that is to say, He created that curious and beautiful machine, the organized human body; but that body was still an inert⁷ structure, without the principle of self-motion. A more noble work remained to be performed; the immaterial spirit, the divine essence, the prime mover of this machine, was to be applied; and, accordingly, we learn that God "breathed into his nostrils the breath of life;" and then, and not till then, "man became a living soul."—LARDNER.

8. "Is, then, the being who such rule maintains
Naught but a bunch of fibres, bones, and veins'?

Is all that acts, contrives, obeys, commands,
Naught but the fingers of two feeble hands' ?
Hands that, a few uncertain summers o'er,
Moulder in kindred dust, and move no more' ?

9. "No': - powers sublimer far that frame inspire,
And warm with energy of nobler fire,
And teach mankind to pant for loftier joys,
Where death invades not, nor disease annoys;
But transports pure, immortal, unconfined,
Fill all the vast capacity of mind."

¹ LĒ'-VER, or LĒV'-ER. See Fourth Reader, p. 312.

² SKĒP'-TIC-AL, doubting.

³ MA-TĒ'-RI-AL-IST, one who denies any spiritual existence apart from matter.

⁴ A-NĀL'-O-ĠY, remote likeness or similarity between different objects.

⁵ HŶ-POTH'-E-SIS, a supposition.

⁶ OR-GĀN'-IC. *Organic* bodies are such as possess organs, on the action of which depend their growth and perfection.

⁷ IN-ĒRT', without power to move.

LES. VI.—VARIOUS PHENOMENA OF THE NERVOUS SYSTEM.

(Adapted from Hooker and other writers.)

I. WHAT IS NECESSARY TO SENSATION AND VOLUNTARY MOTION.

1. THE nerves, branching out to all parts of the body, do not terminate in sharp points, but usually in loops, where impressions from external things are first received; and it is found that if the organ on which the nerve is thus expanded is seriously injured, the nerve will not receive the impression. If the eye be so injured in its textures¹ that the impression of light can not be made on the optic nerve, there can be no vision. So, too, of the other senses. Taste and smell are often impaired, sometimes even destroyed for a time, by an inflammation of the mucous membrane,² on which the nerves devoted to these senses are expanded. This is sometimes the case in a common cold. The trunk of a nerve must also be in a proper condition. If the nerve of vision be pressed upon by a tumor,³ no impression will be transmitted from the images formed in the eye. So, too, if the nerve going to any part of the body be cut off, there can be no transmission of impressions to the brain from that part.

2. Again, it is necessary to sensation that the brain should be in a state to communicate the impression to the mind. If the brain be pressed upon strongly by a depression of the skull from violence, or by effusion⁴ of blood by the rupture⁵ of an artery, as sometimes occurs in apoplexy, there can be no sensation. Excitement of mind, too, sometimes prevents

the occurrence of sensation by its action upon the connection between the mind and the brain. The pain of a wound received in battle is often unfelt until the excitement of the battle is over, and the aching of a tooth is often stopped by the excitement consequent upon going to the dentist to have it extracted.

3. In these cases the cause of the pain is acting all the time upon the nervous extremity, the trunk of the nerve is capable of transmitting the impression, and the brain is doubtless capable of receiving it, but the mind is so intensely occupied with other things that it takes no notice of the messages sent up from the nerves. Thus the mind may at times rise superior to physical suffering, and withdraw itself, to a certain extent, from bodily influences. We witness this in the exultation with which the savage at the stake sings his death-songs, and the Christian heroism⁶ with which martyrs have met death amid the direst tortures of the body. It is on the same principle that the man of stubborn and resolute will is often enabled to resist pain, while the feeble-minded and the irresolute are overcome by it.

II. NERVOUS PARALYSIS.

1. Sometimes the nerves of expression which extend over the face are paralyzed⁷ on one side only. The result is, that while the individual can masticate⁸ equally well on both sides, he can laugh, and cry, and frown only on one side, and he can not close the eye on the side affected. Thus, if the nerve of expression covering the left side of the face be paralyzed, the left eye can not be closed by any effort, and the left side of the face will be wholly devoid of expression. This nerve of expression is often paralyzed by itself, the other nerves in the neighborhood, both nerves of sensation and of motion, being entirely unaffected. This nerve has been called the *respiratory* nerve of the face, because it controls motions which are connected with the movements of respiration.⁹

2. If we observe how the various passions and emotions are expressed, we shall see that there is a natural association between the muscles of the face and those of the chest in this expression. This is very obvious in laughing and in weeping. But this association can be effected only through nervous connections, and these connections in this case are very extensive and intimate. When the nerve of expression, or the facial respiratory nerve, is paralyzed, all the motions of the face connected with the respiration are absent. Though

the individual may sob in weeping, or send forth the rapid and excessive expirations of laughter, yet the face on the side where the nerve is paralyzed will be perfectly quiescent.¹⁰ So, too, those movements of the nostrils which are sometimes used in expression can not be performed. Sneezing can not be done on the affected side, nor can the individual whistle, because a branch of this nerve goes to the muscles at the corner of the mouth, which are therefore disabled. Sir Charles Bell, in cutting a tumor from before the ear of a coachman, divided this branch of the nerve. Shortly after, the man thanked him for curing him of a formidable disease, but complained that he could no longer whistle to his horses.

3. Another singular case of paralysis narrated by Sir Charles Bell is that of a mother who was seized with a paralysis, in which there was a loss of muscular power on one side, and a loss of sensibility on the other. She could hold her child with the arm of the side which retained its power of motion, but had lost its sensibility. But she could do it only when she was looking at it. She could not *feel* her child on the arm, and therefore, when her attention was drawn to any thing else, and she ceased to have her eyes fixed on the child, the muscles, having no overseer, as we may say, to keep them at work, were relaxed at once, and the child would fall from her arm.

III. NO FEELING IN THE NERVES OF MOTION, IN THE BRAIN, OR IN THE HEART.

1. It was formerly supposed that a nerve must, of course, have an exquisite¹¹ sensibility.¹² But there is no sensibility in nerves devoted to motion, as we have already seen. Neither is there any in the brain itself, but only in its enveloping membranes. Portions of the brain may be cut off without producing any pain. The heart, too, is insensible to touch. A case proving this fell under the observation of Harvey, the discoverer of the circulation of the blood. A young nobleman, from an injury received in a fall, had a large abscess¹³ on the chest, which occasioned such a destruction of the parts as to leave the lungs and heart exposed. Charles the First, on hearing of the case, desired Harvey to see it.

2. "When," says Harvey, "I had paid my respects to this young nobleman, and conveyed to him the king's request, he made no concealment, but exposed the left side of his breast, when I saw a cavity into which I could introduce my fingers and thumb. Astonished with the novelty, again and again

I explored the wound; and first, marveling at the extraordinary nature of the case, I set about the examination of the heart. Taking it in one hand, and placing my finger on the wrist, I satisfied myself that it was indeed the heart which I grasped. I then brought him to the king, that he might behold and touch so extraordinary a thing, and that he might perceive, as I did, that, unless when we touched the outer skin, or when he saw our fingers in the cavity, this young gentleman knew not that we touched his heart!"

3. This absence of sensibility in the heart is not because it is not well endowed with nerves. It is well endowed, not with the nerves of ordinary sensation, but with those which are devoted to another purpose. They are nerves of sympathy, which notify the condition of the heart to the seats of involuntary motion in the spinal marrow, and which also establish a connection with every part of the body, making the heart to be so easily affected by motion, by disease, and by every passing emotion in the mind.

IV. THE REUNION AND HEALING OF SEVERED NERVES.

1. There are some wonderful facts in regard to the reunion and healing of severed nerves. It has been seen that if a nerve trunk be divided, all communication between the part which it supplies with branches and the brain is cut off. But the two cut ends of the trunk can grow together, and the communication can thus be more or less restored. This must appear to us passing wonderful when we consider that each nerve trunk is made up of a great number of separate fibres, each one of which goes from its origin in the nervous centre to its destination by itself. For these nerves to heal without causing confusion, it is essentially necessary that each little fibre should unite, at its cut end, with its corresponding end, and not with the end of some other fibre. For example, if the nerves distributed to the hand were cut, it would not do to have the fibres which go to the thumb unite with those which go to a finger.

2. The difficulty of accurate union would seem to us to be still further increased by the fact that, in the same bundle of nerve fibres, the different kinds, those of motion and those of sensation, are bound up together, and we know that it would not do for a nerve of motion to unite with a nerve of sensation. Yet we learn, by repeated experiments, that the most accurate union of severed nerves is often effected, each minute fibre, in whatever position it may be placed, apparently

seeking out and uniting with its severed part, so that eventually the communication of impressions is as perfect as before.

3. But a still more wonderful fact is exhibited in the union of parts which did not originally belong together, as, for example, when a piece of skin is dissected from the forehead, and is twisted down so as to be made to grow on to the nose, to supply a deficiency there. Here entirely new relations are established between the nerves of the divided parts, and, as we should expect, there is confusion in the sensations. The patient at first, whenever the new part of the nose is touched, refers the sensation to the forehead. But this confusion of the sensations is after a while removed. And it is curious to observe, that while the old nervous connections are breaking up, and the new ones becoming established, there is an interval of partial, sometimes entire insensibility in the part. How these new relations can be established consistently with the known arrangement of the fibres in the nerve bundles is a mystery. Physiologists do not attempt to explain it; they merely attribute all such processes to what they call the "Healing Power of Nature."

1 TĒXT'-URES, different parts or layers, each likened to a *web* that is woven.

2 MŪ'-CORS MĒM'-BRĀNE, a thin and slimy flexible skin.

3 TŪ'-MOR, a swelling.

4 EF-FŪ'-SION, a pouring out from the proper vessels.

5 RŪPT'-URE, a breaking.

6 HĒR'-O-TSM, the spirit and conduct of a hero; fortitude.

7 PĀR'-A-LYZED, affected with the palsy; benumbed.

8 MĀS'-TI-CATE, chew; grind with the teeth.

9 RES-PI-RĀ'-TION, the act of breathing.

10 QUI-ES'-CENT, in a state of repose.

11 ĒX'-QUI-SITE, peculiarly delicate; keenly felt. [feeling.]

12 SEN-SI-BĪL'-I-TY, acuteness or delicacy of

13 ĀB'-SCISS, a swelling containing a whitish matter called pus.

LES. VII.—INTEMPERANCE, THE PRIME MINISTER OF DEATH.

1. DEATH, the king of terrors, was determined to choose a prime minister;¹ and his pale courtiers², the ghastly³ train of diseases, were all summoned to attend, when each preferred⁴ his claim to the honor of this illustrious office. Fever urged the numbers he destroyed; cold Palsy set forth his pretensions by shaking all his limbs; and Dropsy, by his swelled, unwieldy carcass; Gout hobbled up, and alleged his great power in racking every joint; and Asthma's inability to speak was a strong though silent argument in favor of his claim. Colic and Rheumatism pleaded their violence; Plague his rapid progress in destruction; and Consumption, though slow, insisted that he was sure.

2. In the midst of this contention, the court was disturbed

by the noise of music, dancing, feasting, and revelry,⁵ when immediately entered a lady, with a confident air and a flushed countenance, attended by a troop of cooks and bacchanals:⁶ her name was INTEMPERANCE. She waved her hand, and thus addressed the crowd of diseases: "Give way, ye sickly band of pretenders, nor dare to vie with my superior merits in the service of this great monarch. Am not I your parent? Do ye not derive the power of shortening human life almost wholly from me? Who, then, so fit as myself for this important office?" The grisly monarch grinned a smile of approbation, placed her at his right hand, and she immediately became his principal favorite and prime minister.—ANONYMOUS.

¹ PRIME MÍN'-IS-TER, a chief officer in civil affairs.

² COURT'-IER, an attendant who flatters to please.

³ GHÁST'-LY, death-like; very pale; hideous.

⁴ PRE-FER'RED, put forward; urged.

⁵ RÉV'-EL-RY, carousing with noisy merriment.

⁶ BÁC'-CHA-NALS, those who indulge in drunken revels.

LESSON VIII.—"LOOK NOT UPON THE WINE."

1. Look not upon the wine when it
Is red within the cup!
Stay not for pleasure when she fills
Her tempting bēaker¹ up!
Though clear its depths, and rich its glow,
A spell² of madness lurks below.
2. They say 'tis pleasant on the lip,
And merry on the brain;
They say it stirs the sluggish³ blood,
And dulls the tooth of pain.
Ay—but within its glowing deeps
A stinging serpent, unseen, sleeps.
3. Its rosy lights will turn to fire,
Its coolness change to thirst;
And, by its mirth, within the brain
A sleepless worm is nursed.
There's not a bubble at the brim
That does not carry food for him.
4. Then dash the brimming⁴ cup aside,
And spill its purple wine;
Take not its madness to thy lip—
Let not its curse be thine.
'Tis red and rich—but grief and woe
Are in those rosy depths below.—WILLIS.

¹ BĒAK'-ER, a drinking-cup or glass.

² SPELL, a charm consisting of words of hidden power.

³ SLŪG'-GISH, having little motion.

⁴ BRĪM'-MING, full to the very brim.

LESSON IX.—THE WATER-DRINKER.

1. OH, water for me! bright water for me,
And wine for the tremulous debauchee.¹
Water cooleth the brow, and cooleth the brain,
And maketh the faint one strong again;
It comes o'er the sense like a breeze from the sea,
All freshness, like infant purity;
Oh, water, bright water, for me, for me!
Give wine, give wine, to the debauchee!¹
2. Fill to the brim! fill, fill to the brim;
Let the flowing crystal² kiss the rim!
For my hand is steady, my eye is true,
For I, like the flowers, drink nothing but dew.
Oh, water, bright water's a mine of wealth,
And the ores which it yieldeth are vigor and health.
So water, pure water, for me, for me!
And wine for the tremulous debauchee!
3. Fill again to the brim, again to the brim!
For water strengtheneth life and limb.
To the days of the aged it addeth length,
To the might of the strong it addeth strength;
It freshens the heart, it brightens the sight,
'Tis like quaffing a goblet of morning light!
So, water, I will drink nothing but thee,
Thou parent of health and energy!
4. When over the hills, like a gladsome bride,
Morning walks forth in her beauty's pride,
And, leading a band of laughing hours,
Brushes the dew from the nodding flowers,
Oh! cheerily then my voice is heard
Mingling with that of the soaring bird,
Who flingeth abroad his matin³ loud,
As he freshens his wing in the cold gray cloud.
5. But when evening has quitted her sheltering yew,
Drowsily flying, and weaving anew
Her dusky meshes o'er land and sea,
How gently, O sleep, fall thy poppies⁴ on me!
For I drink water, pure, cold, and bright,
And my dreams are of Heaven the livelong⁵ night.
So hurra for thee, water! hurra! hurra!
Thou art silver and gold, thou art ribbon and star:
Hurra for bright water! hurra! hurra!

E. JOHNSON.

¹ DEB-AU-CHIE' (deb-o-shee'), a profligate; a drunkard.

² CRÏS'-TAL, here used for *water*, which is clear as crystal.

³ MĀT'-IN, morning song.

⁴ PŌP'-PĒS, opium, obtained from the poppy. lulls to sleep.

⁵ LIVĒ'-LONG, long in passing.

LESSON X.—HOW THE MIND SPEAKS THROUGH THE NERVES AND MUSCLES.

(Adapted chiefly from Sir Charles Bell.)

“There’s a language that’s *mute*, there’s a silence that *speaks*;
There is something that can not be *told*;
There are *words* that can only be read on the *cheeks*;
And *thoughts*—but the *eye* can unfold.”

1. THERE is quite as much truth as poetry in the above lines—and, indeed, poets are often the most faithful interpreters of nature. Spoken and written language are not the only methods by which mind communicates with mind; and it will be found, on examination, that “the language that’s mute,” and that is read only in the “moving play of the muscles,” forms the greater portion of the language of daily life.

2. Thoughts and feelings are expressed only by muscular motion as controlled by the nerves. Even the voice in speaking, and the hand in writing, merely translate the language of the muscles into conventional¹ signs; but it is more especially of the mute language of the features, and of bodily motions, that we are now to speak. As we watch an animated speaker, we observe that not only are the muscles of the forehead, the eyebrows, the eyes, the cheeks, the nose, and the mouth in almost constant action, but the head is nodded or shaken, the shoulder is shrugged, the foot is stamped, the body variously inclined, and, above all, the hand executes a great variety of motions, and all to give force to the thoughts and feelings which the mouth utters.

3. Various muscles of the human features are also used to express thought or passion without any connection with the voice. So, also, the feelings or emotions which are attributed to the heart find expression here. Says the Son of Sirach, “The heart of a man changeth his countenance, whether for good or evil.” And so also Shakspeare, “I do believe thee; I saw his heart in his face.” Certain strong feelings of the mind produce a disturbed condition of the heart; thence the impulse is sent to the organs of breathing, which then give us, in this indirect way, the outward signs of the mental emotion. Sir Charles Bell says, “The man was wrong who found fault with Nature for not placing a window before the heart, in order to render visible human thoughts and intentions. There is, in truth, provision made in the countenance and outward bearing for such discoveries.” These principles form a rational basis for the science of physiognomy.²

4. The heart and the lungs are so intimately connected by nerves that the closest sympathy exists between them; nor has the mind always sufficient control over them to allay the excitement which a word or a whisper may have occasioned. Thus the "feelings of the heart," as they are called, will express themselves by outward signs, distinct from those which the mind directly controls. We can readily conceive why a man, under the influence of terror, stands with eyes intently fixed on the object of his fears, the eyebrows elevated to the utmost, and the eye largely uncovered; and why he moves with hesitating and bewildered steps, and glances his eye wildly around him. In all this, the mind acts directly on the outward organs. But observe this man further: there is a spasm on his breast; he can not breathe freely; the chest is elevated, the muscles of his neck and shoulders are in action, his breathing is short and rapid, there is a gasping and convulsive motion of his lips, a tremor on his hollow cheek, a gulping and catching of his throat—and why does his heart knock at his ribs while yet there is no force of circulation?—for his lips are ashy pale.

5. Sometimes the mind, by a strong effort, can restrain, to some extent, the outward expressions of emotion, at least in regard to the general bearing of the body; but who, while suffering under the influence of any strong emotion, can retain the natural fullness of his features, or the healthful color of his cheek, and unembarrassed respiration? The murderer may command his voice, and mask his purpose with light words, or carry an habitual sneer of contempt of all softer passions; but his unnatural paleness, and the sinking of his features, will betray that he suffers. Clarence says to his murderer,

"How *deadly* dost thou speak!
Your eyes do menace me: why look you pale?"

6. Thus the frame of the body, though constituted for the support of the vital functions, becomes the instrument of expression, and in the anatomy of the system we find the cause. We see why, when the mind suffers, the breathing should be agitated, for then the ordinary involuntary motions of the respiratory organs are interfered with by a more potent³ nervous influence than ordinary; we see why the muscles of the throat should be affected with spasm—why slight quivering motions pass from time to time over the face, the lips and cheeks, and nostrils; why the voice sticks in the throat, and the paralyzed⁴ lips refuse the commands of the will; and why

even *the walk* should often indicate the workings of the mind, or the general character of the individual.

“You may sometimes trace
A feeling in each footstep, as disclosed
By Sallust in his Catiline, who, chased
By all the demons of all passions, showed
Their work even by the way in which he trode.”

¹ CON-YĖN'-TION-AL, agreed upon, or arising out of custom. ³ PŌ'-TENT, powerful.

² PHYS-I-ŌG'-NO-MY, the science of discerning the character from the face.

⁴ PĀR'-A-LYZED, benumbed; incapable of motion.

LESSON XI.—THE LANGUAGE OF THE COUNTENANCE.

(Continued.)

(Adapted chiefly from Sir Charles Bell.)

Fig. 8.

THE FACIAL NERVE.



Fig. 8 shows the Facial Nerve—the nerve of expression of the countenance. All the principal divisions and branches of this nerve, and their exact localities, are known to anatomists and named by them; but it is not necessary to specify them here. Each nerve branch has its appropriate office to perform in moving the contiguous muscles; and it is only when we consider the vast number of combinations that may be made of them that we begin to realize the wonderful versatility of this *natural* language of the human countenance. It must be remembered that on the opposite side of the head is another facial nerve, the exact counterpart of the one here represented, and that the facial is but one of twelve *pairs* of cranial nerves distributed to the different parts of the head. Injury of the facial nerve produces paralysis of the parts to which it is distributed, rendering the muscles of the face powerless, and the countenance therefore distorted. So of the other cranial nerves; yet *one* of a *pair*—as one eye, one ear, one nostril, etc.—may be affected, and the

other continue in healthy action.

1. IN the preceding lesson we treated, generally, of the language of muscular motion; but the various expressions of the human countenance, in particular, are what we would now notice, together with the immediate causes which produce them. Over each side of the face and each half of the head extends what is called the *facial* nerve; and it is through this and its numerous and minute ramifications¹ that are produced those movements of the muscles which give to the face its wonderful variety of expression—the mute language of thought, feel-

ing, and emotion. What a wonderful net-work of nervous fibres is here set apart for the purpose of producing the only universal language which is known and read of all mankind!

2. It will be interesting to know how some of the expressions of the countenance are produced. If we will notice, we shall observe that the wrinkling of the muscles of the eyebrow and forehead causes a frown to pass over the features; when a smile occurs, it is produced by the muscles which raise the corners of the mouth; and when sadness is expressed, it is by the opposite action of drawing down the corners of the mouth. Hence the origin of the common expression, "Down in the mouth."



Fig. 9.—Laughter.

In hearty laughter, which is represented in the annexed engraving, the muscles which raise the corner of the mouth act strongly, pushing up and wrinkling the cheek, while the eyes are nearly closed by the action of the circular muscle of the eyelids. The muscles of the throat, neck, and chest, are also agitated, and so violently that the individual may be said to be actually "convulsed" with laughter.

3. In severe weeping, on the contrary, the muscles that draw down the corners of the mouth act strongly, the muscles of the eyelids contract with great force, closing the eyes, and the frowning muscle at the same time wrinkles the eyebrows. The cheeks, drawn between two adverse powers, lose their joyous elevation, the breathing is cut short by sobbing, the inspiration is hurried, and the expiration is slow, with a melancholy note. In weeping, the same muscles are affected as in laughter; but they act differently, and the expression is as much opposed to that of



Fig. 10.—Crying.

laughter as the nature of the emotion which produces it.

4. In unrestrained rage, which is a brutal passion, the

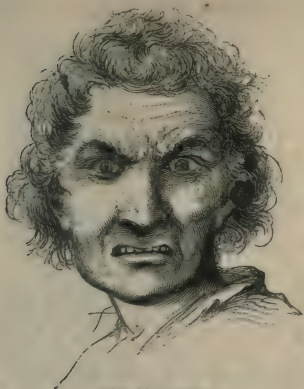


Fig. 11.—Rage.

by the violence of passion.

5.

The pagan lord, to such affronts unused,
Bit both his lips, wrath's strangled orators ;
He would have spoke, but only sounds confused
Broke forth, such sounds as when a lion roars ;
Or, as when lightning cleaves the stormy doors
Of heaven, to rouse from its reluctant rest
The thunder growling as the tempest pours ;
For every word, which he with pain express'd,
Escaped in tones as gruff from his infuriate breast.—Canto vi. 88.



Fig 12.—Bodily Fear.

modic affection of the muscles of the chest, a trembling of the lips, a hollowness and convulsive motion of the cheeks, and a cadaverous⁴ aspect, caused by the receding of the blood.

7. Terror, that species of fear which rouses to defend or escape, is thus alluded to by Shakspeare :

whole frame trembles, the features are unsteady, and the whole visage is sometimes pale, sometimes dark and almost livid;² the exposed eyeballs roll and are inflamed, the forehead is alternately knit³ and raised in furrows, the nostrils are inflated to the utmost, the lips are swollen, the corners of the mouth open, and the teeth are so firmly closed that words escape with difficulty. Tasso, in describing the rage of Argantes, dwells with great effect upon this "strangling of speech"

6. Bodily fear gives to the features a different expression, by differently affecting the muscles. In men, as in animals, the expression is without dignity—the mean anticipation of pain. Here the frontal muscle, unwrinkling the eyebrows, raises them to their fullest extent ; the eyeball is largely uncovered, and the eyes staring ; the whole upper lip is raised instead of a part of it. The nostrils are spread out, and the lower jaw is fallen, while in rage it is in the opposite condition. There is a spas-

Canst thou quake and change thy color',
Murder thy breath in middle of a word',
And then again begin', and stop again',
As if thou wast distraught⁵ and mad with terror'?—*Richard III.*

But when terror is mixed with astonishment, the fugitive⁶ and unnerved steps of mere terror are changed for the rooted and motionless figure of a creature appalled and stupefied. Spenser characterizes well this kind of terror:

He answer'd naught at all; but, adding new
Fear to his first amazement, staring wide
With stony eyes, and heartless hollow hue,
Astonish'd stood, as one that had espy'd
Infernal furies with their chains unty'd.



Fig. 13.—Jealous Melancholy.

the corners of the mouth are drawn down, and the chin drawn up; notice the peevish turn given to the lowering eyebrows, and the peculiar meeting of the perpendicular and transverse⁹ furrows of the forehead.

9. Envy, which “consumeth a man as a moth doth a garment,” has a similar expression. Jealousy, which is a fitful and unsteady passion, is marked by a frowning and dark obliquity¹⁰ of the eyes; and suspicion by the same, combined with earnest attention. The latter passion is thus forcibly characterized by Spenser in his *Faery Queen*:

Foul, ill-favored and grim,¹¹
Under his eyebrows looking still askance;
And ever as Dissemblance laughed on him,
He lower'd on her with dangerous eye glance,
Showing his nature in his countenance:
His rolling eyes did never rest in place,
But walked each where, for fear of hid mischance,¹²
Holding a lattice still before his face,
Through which he still did peep as forward he did pace.—*B. iil., c. 12.*

10. It is an important truth that all these muscular movements, which give expression to the countenance, are directed and controlled by the nervous influence transmitted from the

brain through the nerve fibres, as shown in the engraving at the head of this lesson. Is not the variety of expression thus produced a very striking proof of design—an evidence that all our emotions are intended to have their appropriate outward characters?

¹ RAM-I-FI-CĀ'-TIONS, branchings.

² LĪV'-ID, black and blue.

³ KNĪT, contracted.

⁴ ĆA-DĀV'-ER-OUS, like a dead body; pale.

⁵ DIS-TRAUGHT' (*dis-travt'*), distracted.

⁶ FĪ'-ĆI-TĪVE, inclined to flee away.

⁷ TĒST'-Y, petulant; fretful.

⁸ ĆON-TĒMN'-ED, regarded with contempt.

⁹ TRANS-VĒRSE', running crosswise.

¹⁰ OB-LIŪ'-ŪI-TY (*ob-lik'-we-ty*), a deviation from a right line.

¹¹ GEĪM, adapted to create terror; ill-looking.

¹² MIS-CHĀNCE', ill fortune.

LESSON XII.—USES OF ANATOMY AND PHYSIOLOGY TO THE PAINTER.

1. As anatomy makes us acquainted with that structure by which the mind expresses emotion, and through which the emotions are controlled and modified, it introduces us to the knowledge of the relations and mutual influences which exist between the mind and the body. To the painter, therefore, the study is necessarily one of great importance. It does not teach him to use his pencil', but it teaches him to observe nature', to see forms in their minute varieties, which, but for the principles here elucidated,¹ would pass unnoticed'; to catch expressions so evanescent² that they must escape him' did he not know their sources'. It is this reducing of things to their principles which elevates his art into a connection with philosophy', and which gives it the character of a liberal³ art.'

2. Anatomy leads to the observation of all the characteristic varieties which distinguish the frame of the body or countenance. A knowledge of the peculiarities of infancy, youth, or age'; of sickness or robust health'; or of the contrasts between manly and muscular strength and feminine delicacy'; or of the appearances which pain or death present', belongs to its province as much as the study of the muscles of the face when affected by emotion'. Viewed in this comprehensive light, anatomy forms a science not only of great interest, but one which will be sure to give the artist a true spirit of observation, teach him to distinguish what is essential to just expression, and direct his attention to appearances on which the effect and force, as well as the delicacy of his delineations,⁴ will be found to depend.—SIR CHARLES BELL.

¹ E-LĪ'-CI-DĀ-TED, made plain.

² EY-A-NĒS'-CENT, fleeting; quickly passing away.

³ LĪB'-ER-AL, embracing elegant culture, as

the liberal arts—such as painting, music, etc.

⁴ DE-LIN-E-Ā'-TIONS, drawings of the outlines of a thing.

LESSON XIII.—MARVELS OF HUMAN CALORIC.

ECLECTIC REVIEW.

[In the Fourth Reader, page 54, the principle of animal heat was explained as being caused by the union of the *oxygen* of the air with the *carbon*, or worn-out particles of our bodies. This carbon, taken in as a part of our food, and being used to form the tissues of the body, is dislodged, particle by particle, whenever we move a muscle, be it of the heart, lungs, or limbs, and whenever we think or feel; and it is then that the union with oxygen—that is, the combustion, takes place. The more intensely, therefore, we think, and act, and feel, the more carbon we burn, and the more repairs our bodies need. The condition of life is, therefore, death, and the faster we live, the more rapidly are the particles of our bodies burning up—passing away. The following humorous article may help to fix some of these principles in our memories.]

1. WE must be plain with our readers. It will not do to mince matters where questions of science are concerned. Dainty¹ people will, no doubt, object to the proposition we are about to advance. Nevertheless, we persist. Fearless of the consequences, utterly unawed by the hisses which we know will ensue, we proceed to lay down the following assertion: We are all living stoves—walking fireplaces—furnaces in the flesh.

2. Now we do not intend to say that any one can light a cigar, or boil an egg, or even ignite² a lucifer-match at these human hearths. Still, we repeat, these bodies of ours are stoves—fireplaces—furnaces if these terms can be applied to any apparatus for the express production of caloric. And is not heat produced in the human body by the union of oxygen with carbon, just the same as by the burning of wood in an open fireplace? and does not this union take place in the capillaries of the blood-vessels?

3. But, granting that our bodies are veritable stoves, the reader will desire to know where we procure our fuel. Fortunately, our coal and fire-wood are stored up in a very interesting form. They are laid before us in the shape of bread and butter, puddings and pies; rashers³ of bacon for the laborer, and haunches⁴ of venison or turtle-soup for the epicure.⁵ Instead of being brought up in scuttles, they are presented in tureens, dishes, or tumblers, or all of them, in pleasant succession.

4. In fact, whenever you send a person an invitation to dinner, you virtually request the honor of his company to take fuel; and when you see him enthusiastically employed on your dainties, you know that he is literally “shoveling” fuel into his corporeal stove. The ultimate form in which this fuel is burnt in the capillaries is that of carbon, with a little hydrogen and sulphur; but we swallow it in the shape of fat,

starch, sugar, alcohol, and other less inflammatory compounds. By far the most heating of these substances is fat; ten pounds of this material, imported into your stove, will do as much work—that is, will produce as much warmth as twenty-five pounds of starch, twenty-five of sugar, or even twenty-six of spirits.

5. And a pleasant thing it is to observe how sagaciously the instinct of man has fastened upon the articles which will best supply him with the species of fuel he requires. The Esquimaux is extremely partial to oily fare. He does not know why. He never heard of the doctrine of animal heat. But he feels intuitively⁶ that bear's grease and blubber are the things for him. Condemn him to live on potatoes or Indian corn, and the poor fellow would resent the cruelty as much as an alderman of the old school if sentenced to subsist on water-gruel alone.

6. And the savage would be perfectly right. Exposed as he is to the fierce cold of a northern sky, every object around him plundering him of his caloric incessantly, what he needs is plenty of oily food, because from this he can produce the greatest quantity of heat. On the other hand, the native of the tropics, equally ignorant of animal chemistry, eschews⁷ the fiery diet which his climate renders inappropriate, and keeps himself cool on rice, or dates, or watery fruits.

7. Hence we see the reason why a very stout man, if deprived of food, can keep up his corporeal fires for a longer time than a slender one. Human fat is fuel laid away for use. It constitutes a hoard of combustible material upon which the owner may draw whenever his ordinary supplies are intercepted. Let all plump persons therefore rejoice. We offer them our hearty, perhaps somewhat envious congratulations. They, at any rate, are prepared to stand a long siege from cold.

8. For the same reason, animals which hibernate,⁸ like the bear, jerboa, marmot, dormouse, bat, and others, generally grow plump before they retire into winter-quarters. Upon their capital of fat they subsist during their lethargy,⁹ the respiration being lessened, the pulse reduced to a few beats per minute, and the temperature perhaps nearly to the freezing point. But, when the season of torpor terminates, they issue from their caves and burrows meagre and ravenous, having burnt up their stock of fuel, Bruin¹⁰ himself appearing to be anxious to defraud the perfumers of the unguent¹¹ which is so precious in their eyes.

9. But perhaps the most striking feature in this warmth-producing apparatus within us is the self-regulating power which it possesses. The fires on our domestic hearths decline at one moment and augment at another. Sometimes the mistress of the house threatens to faint on account of excessive heat; sometimes the master endeavors to improve the temperature by a passionate use of the poker, with an occasional growl respecting the excessive cold.

10. Were such irregularities to prevail unchecked in our fleshy stoves, we should suffer considerable annoyance. After a meal of very inflammatory materials, or an hour spent in extraordinary exertion, the gush of caloric might throw the system into a state of high fever. How is this prevented? In some of our artificial stoves, little doors or slides are employed to control the admission of air; in furnaces connected with steam-engines, we may have dampers which will accomplish the same purpose by the ingenious workings of the machine itself.

11. But neither doors nor dampers, pokers nor stokers,¹² can be employed in the bodily apparatus. If, on the one hand, our human fires should begin to flag from undue expenditure of heat, the appetite speaks out sharply, and compels the owner to look round for fuel. Hunger rings the bell, and orders up coals in the shape of savory meats. Or, should the summons be neglected, the garnered fat, as we have seen, is thrown into the grate to keep the furnace in play.

12. If, on the other hand, the heat of the body should become unreasonably intense, a very cunning process of reduction is adopted. When a substance grows too hot, the simplest method of bringing it into a cooler frame is to sprinkle it with water. This is precisely what occurs in our human frames. For no sooner does our internal heat rise above its standard height than the perspiration tubes, with their six or seven millions of openings, indignant at the event, begin to pour out their fluid, so as to bathe the surface of the whole body. Whenever, therefore, a man becomes overheated by working, running, rowing, fighting, making furious speeches, or other violent exertions, he invariably resorts to this method of quenching the heat by "pouring on water."

13. What shall we say, then, good reader? Speaking seriously, and looking at the question from a mere human point of view, could any project appear more hopeless than one for burning fuel in a soft, delicate fabric like the human body—a fabric composed for the most part of mere fluids—a fabric

which might be easily scorched by excess of heat or damaged by excess of cold? Does not it seem strange that a stove should have flesh for its walls, veins for its flues, and skin for its covering? Yet here is an apparatus which, as if by magic, produces a steady stream of heat—not trickling penuriously from its fountains, but flowing on day and night, winter and summer, without a moment's cessation, from January to December.

14. Carry this splendid machine to the coldest regions on the globe, set it up where the frosts are so crushing that nature seems to be trampled dead, still it pours out its mysterious supplies with unabated profusion. It is an apparatus, too, which does its work unwatched, and, in a great measure, unaided. The very fuel, which is thrown into it in random heaps, is internally sifted and sorted, so that the true combustible elements are conveyed to their place and applied to their duty with unerring precision.

15. No hand is needed to trim its fires, to temper its glow, to remove its ashes. Smoke there is none, spark there is none, flame there is none. All is so delicately managed that the fairest skin is neither shriveled nor blackened by the burning within. Is this apparatus placed in circumstances which rob it too fast of its caloric? Then the appetite becomes clamorous for food, and, in satisfying its demands, the fleshy stove is silently replenished. Or, are we placed in peril from superabundant warmth? Then the tiny flood-gates of perspiration are flung open, and the surface is laid under water until the fires within are reduced to their wonted level.

16. Assailed on the one hand by heat, the body resists the attack, if resistance be possible, until the store of moisture is dissipated; assailed on the other by cold, it keeps the enemy at bay until the hoarded stock of fuel is expended. Thus protected, thus provisioned, let us ask whether these human hearths are not entitled to rank among the standing marvels of creation? for is it not startling to find that, let the climate be mild or rigorous, let the wind blow from the sultry desert, or come loaded with polar sleet, let the fluctuations of temperature be as violent as they may without us, there shall still be a calm, unchanging, undying summer within us?

¹ DĀIN'-TY, delicate; affectedly nice.

² IG-NĪTE', to kindle.

³ RĀSH'-ER, a thin slice.

⁴ HĀUNCH, the hip.

[ries of the table.

⁵ ĒP'-I-CŪRE, one who indulges in the luxu-

⁶ IN-TŪ'-I-TĪVE-LY, perceived directly by the mind, without reasoning.

⁷ ES-CHEWS', shuns, or avoids.

⁸ HY'-BEE-NĀTE, pass the winter in seclusion.

⁹ LĒTH'-AR-ĠY, morbid drowsiness.

¹⁰ BRŪ'-IN, a name given to a bear.

¹¹ ŪN'-GUENT, ointment.

¹² STŪ'-KER, one who attends to the fire.

LESSON XIV.—LINES ON A SKELETON.

[About forty years ago the London *Morning Chronicle* published a poem entitled "Lines on a Skeleton," which excited much attention. Every effort, even to the offering a reward of fifty guineas, was vainly made to discover the author. All that ever transpired was that the poem, in a fair clerical hand, was found near a skeleton of remarkable beauty of form and color, in the Museum of the Royal College of Surgeons, Lincoln's Inn, London, and that the curator of the museum had sent them to Mr. Perry, editor and proprietor of the *Morning Chronicle*.]

1. BEHOLD this ruin'! 'Twas a skull,
Once of ethereal spirit full.
This narrow cell was Life's retreat',
This space was Thought's mysterious seat.
What beauteous visions filled this spot',
What dreams of pleasure long forgot.
Nor Hope, nor Love, nor Joy, nor Fear',
Have left one trace of record here.
2. Beneath this mouldering canopy
Once shone the bright and busy eye';
But, start not at the dismal void—
If social Love that eye employed';
If with no lawless fire it gleamed,
But through the dews of kindness beamed',
That eye shall be forever bright
When stars and suns are sunk in night.
3. Within this hollow cavern hung
The ready, swift, and tuneful tongue.
If Falsehood's honey it disdained,
And where it could not praise, was chained';
If bold in Virtue's cause it spoke,
Yet gentle Concord never broke'!
This silent tongue shall plead for thee
When Time unveils Eternity.
4. Say', did these fingers delve the mine'?
Or with its envied rubies shine'?
To hew the rock, or wear the gem,
Can little now avail to them.
But if the page of Truth they sought,
Or comfort to the mourner brought',
These hands a richer meed shall claim
Than all that wait on Wealth or Fame.
5. Avails it whether bare or shod,
These feet the paths of duty trod'?—
If from the bowers of Ease they fled,
To seek Affliction's humble shed,
If Grandeur's guilty bribe they spurned,
And home to Virtue's cot returned',
These feet with angel's wings shall vic,
And tread the palace of the sky.

LES. XV.—EDUCATION OF THE MUSCLES OF EXPRESSION.

(Adapted chiefly from Hooker.)

1. As the muscles of the face are the instruments of the mind in the expression of thought, feelings, and emotions, it is highly important that they should be well trained to perform with ease and grace their appropriate functions;¹ for the highest degree of beauty, which is the beauty of expression, depends much more upon the attitudes and movements of the face than upon the shape of the features. We often see a face that is beautiful in repose become ugly the moment it is in action, because the movements of the muscles are so uncouth;² and, on the other hand, we often see faces which are very irregular in the shape of the features, display great beauty when in action, owing to the easy and graceful movements of the muscles of expression. Addison has justly said, "No woman can be handsome by the force of features alone, any more than she can be witty only by the help of speech."

2. Children not unfrequently form awkward habits in the use of the muscles of the face, which finally become permanent; and a little observation will convince us that there is nearly as much difference in skill in the use of these muscles as in the use of those of the hand. For higher examples of this skill we need not go to the accomplished orator or actor; we shall find them exhibited, in the ordinary intercourse of life, in those who have great capacity of expression, together with a mind uncommonly refined and susceptible. In them every shade of thought and feeling is clearly and beautifully traced in the countenance. While this is the result of education of the muscles of expression, an education of which the individual is for the most part unconscious, no direct attempt in the training of these muscles will succeed *unless the mind itself be of the right character.*

3. Awkwardness of expression, arising from habit, may be counteracted by judicious physical training, but intelligence and kindness can not be made to beam from the countenance if they do not emanate³ from the moving spirit within. They are often awkwardly counterfeited, the one by the bustling air assumed by the face of the shallow pretender, and the other by the smirk of him who smiles only to get favor or profit from others. On the other hand, not only will those evil and malignant passions, which are of a decidedly marked

expression, leave their permanent traces in the countenance, but coarse feelings and brutal instincts write their images there also, and nothing but a thorough change of character can possibly efface them. We must therefore begin with the mind and the heart if we would educate the countenance to the higher expressions of beauty.

4. Some of the most striking exemplifications of the influence of the mind and heart upon the expressions of the countenance are to be seen in those institutions where juvenile outcasts from society are redeemed from their degradation by the hand of benevolence. The progress of the mental and moral cultivation may often be traced, from week to week, and sometimes from day to day, in the changing lineaments⁴ of the face, as lively intelligence takes the place of stolid⁵ indifference, and refined sentiment that of brutal passion. Sometimes a few weeks suffice to change the whole character of the expression in the faces of the young. The dull eye becomes bright, not from any change in the eye itself, but from the intelligence and sentiment that now play upon the muscles in its neighborhood. But where passions have been making their impress on the countenance during a long course of years, so that the features become fixed in the prevailing expression, the traces are not so easily removed.

5. The habitual expression of the countenance, depending as it does upon the habitual condition of the muscles, is seen after death. In the state of relaxation which immediately occurs at death, the face is very inexpressive, because its muscles are, together with those of the whole body, so entirely relaxed. But very soon they begin to contract, and, as they assume that degree of contraction to which they were habituated during life, they give to the countenance its habitual expression.

6. It is when this has taken place—when the muscles, recovering from the relaxation of the death-hour, resume their accustomed attitude, as we may express it, that the countenance of our friend appears so natural to us, and we are held, as if by a charm, gazing upon the intelligence and affection beaming there amid the awful stillness of death, till it seems as if those lips must have language. And this expression is retained through all the period of rigidity, till it is dissolved by the relaxation which succeeds this state and ushers in the process of decay. It is thus that the soul, as it takes its flight, leaves its impress upon the noblest part of its tabernacle⁶ of flesh; and it is not effaced⁷ till the last vestige⁸ of life is gone,

and the laws of dead matter take possession of the body. This state of countenance is thus beautifully alluded to by Byron:

7.

He who hath bent him o'er the dead,
 Ere the first day of death has fled,
 The first dark day of nothingness,
 The last of danger and distress
 (Before decay's effacing fingers
 Have swept the lines where beauty lingers),
 And mark'd the mild angelic air,
 The rapture of repose that's there,
 The fix'd yet tender traits that streak
 The languor of the placid cheek,
 And—but for that sad, shrouded eye,
 That fires not, wins not, weeps not now,
 And but for that chill, changeless brow,
 Where cold obstruction's apathy
 Appalls the gazing mourner's heart,
 As if to him it could impart
 The doom he dreads, yet dwells upon—
 Yes, but for these, and these alone,
 Some moments, ay, one treacherous hour,
 He still might doubt the tyrant's power;
 So fair, so calm, so softly sealed,
 The first, last look by death revealed!
 So coldly sweet, so deadly fair,
 We start, for soul is wanting there.
 This is the loveliness in death
 That parts not quite with parting breath;
 But beauty with that fearful bloom,
 That hue which haunts it to the tomb,
 Expression's last receding ray,
 A gilded halo hovering round decay,
 The farewell beam of feeling pass'd away!
 Spark of that flame, perchance of heavenly birth,
 Which gleams, but warms no more its cherish'd earth!

1 FŪNC'-TIONS, actions or offices.

2 UN-CŌUTH', awkward; ungraceful.

3 ĒM'-A-NĀTE, flow or proceed from.

4 LĪN'-E-A-MENTS, outlines; features.

5 STŌL'-ID, stupid.

6 TĀB'-ER-NA-CLE, a temporary habitation.

7 EF-FACED', removed; rubbed out.

8 VĒS'-TIGE, the remains; the trace.

LES. XVI.—DISORDERS OF THE NERVOUS SYSTEM.

VISIONS, APPARITIONS, AND DREAMS, AS VIEWED IN CONNECTION WITH PHYSIOLOGY.

1. It has already been stated that a knowledge of external things is conveyed to the brain through the medium of the nerves of sensation. *How* the items of knowledge thus obtained are stored up in the brain, and *how* the mind is able to recall them in some subsequent period, and form of them new combinations, has usually been thought to belong especially to the department of mental philosophy to consider: but even here it will be found that anatomy and physiology furnish the safest guides to investigation.

2. The involuntary¹ action of the muscles of the heart and lungs is accounted for on the supposition that, at the origin of the nerves which control them, an amount of directing nerv-

ous force is stored up sufficient to continue the motion, without mental control, until the supply is exhausted. It is also believed that the sensations which the nerves of taste, touch, smell, sight, and hearing convey to the brain, leave upon that organ, or stored up in its *sensorium* or seat of power, impressions which can be fully eradicated² only by death; and that these impressions, which may be regarded as images of the outward world, the mind makes use of in memory, in imagination, in visions, in fancied apparitions, and in dreams, often forming new and strange combinations very different from the original impressions.

3. Some physiologists believe that every impression made upon the material substance of the brain produces some permanent change in its structure, and that one impression never completely effaces another; that the mind can, as it were, *see all of them*, and that what the mind or soul thus learns, death itself can not destroy. Even certain physical phenomena, explained by Dr. Draper, give countenance to the theory of permanent impressions upon the material substance of the brain. He says, "If on a cold, polished piece of metal, any object, as a wafer, is laid, and the metal then be breathed upon, and, when the moisture has had time to disappear, the wafer be thrown off, though now upon the polished surface the most critical inspection can discover no trace of any form, yet, if we breathe upon it, a spectral³ figure of the wafer comes into view, and this may be done again and again.

4. "Nay, even more"; if the polished metal be carefully put aside where nothing can deteriorate⁴ its surface, and be so kept for many months, on breathing again upon it the shadowy form emerges; or, if a sheet of paper on which a key or other object is laid be carried for a few moments into the sunshine, and then instantaneously viewed in the dark, the key being simultaneously removed, a fading spectre of the key on the paper will be seen; and if the paper be put away where nothing can disturb it, and so kept for many months, if it then be carried into a dark place and laid on a piece of hot metal, the spectre of the key will come forth. In the case of bodies more highly phosphorescent than paper, the spectres of many different objects which may have been in succession laid originally thereupon will, on warming, emerge in their proper order.

5. "I introduce these illustrations," says Dr. Draper, "for the purpose of showing how trivial are the impressions which may be thus registered and preserved. Indeed, I believe that

a shadow never falls upon a wall without leaving thereupon its permanent trace—a trace which might be made visible by resorting to proper processes. But if on such inorganic⁵ surfaces impressions may in this way be preserved, how much more likely is it that the same thing occurs in the purposely constituted ganglia⁶ of the brain!" But, whether the impressions of sense be permanently fixed in the material substance of the brain or not, there is no reason for supposing that any perceptions which the mind has once taken notice of can ever be lost; and if at any time memory fails to recall them, it is because the brain, and not the mind itself, has become impaired.

6. While, in the exercise of ordinary memory, perceptions and trains of thought are recalled in their real character and natural order, it is not so in what are called visions, fancied apparitions, and in dreams. The most common visions—unreal objects which we fancy—are doubtless the remains of impressions which have been made on the optic⁷ nerve, and which are recalled by a strong mental effort. Others arise from disease of the nerve, often producing, by the impressions conveyed from the diseased nerve to the brain, grotesque images among the real objects at which we are looking. Some unusual pressure of blood upon this nerve will often produce apparent flashes of light, or objects apparently floating in the air. These appearances are indications of disease in the nerve.

7. When, in addition to the optic⁷ nerve, portions of the brain become affected by disease, former impressions often become mingled with the present, and the complicated scenes of a passing drama are displayed. Thus, in the delirium tremens, which follows a cessation from the customary use of alcohol, phantoms appear moving around among real objects. "The form of a cloud no bigger than the hand may perhaps first be seen floating over the carpet; but this, as the eye follows it, takes on a sharp contour⁸ and definite shape, and the sufferer sees with dismay a moping raven on some of the more distant articles of furniture. Or, out of an indistinct cloud, faces, sometimes of surprising loveliness, but more frequently of hideous aspects, emerge, one face succeeding as another dies away. The mind, ever ready to practice imposture upon itself, will at last accompany the illusion with grotesque or even dreadful inventions."

8. The illusions to which one is subject under such derangements of the brain take a character from the previous occupations, travel, mental habits, or reading of the sick man.

Former trains of thought, and former scenes, although often confusedly mingled, assume, to the individual himself, all the vividness of existing realities. "I saw," says De Quincey in his Confessions of an Opium Eater, "as I lay awake in bed, vast processions, that passed along in mournful pomp; friezes⁹ of never-ending stories,¹⁰ that to my feelings were as sad and solemn as if they were stories drawn from times before Œdipus or Priam, before Tyre, before Memphis; and, at the same time, a corresponding change took place in my dreams; a theatre seemed suddenly opened and lighted up within my brain, which presented nightly spectacles of more than earthly splendor."

9. What are called "apparitions," or spectral appearances, physiology explains upon satisfactory scientific principles. They arise sometimes from a disturbance of the retina¹¹ alone, which gives a false interpretation of present impressions, sometimes from the vivid recalling of old images which have been stored up in the brain, but which the mind then looks upon as present realities, and sometimes the two causes unite to produce the effect. Upon these principles, the mind, in apparitions, could never see any thing absolutely *new* to it. And such are the facts. Thus the Greeks and the Romans were just as liable to disorders of the nervous system as we are; but to them supernatural appearances came under the mythological forms of their heathen divinities. The ascetics¹² of the Middle Ages saw phantoms of the Virgin and the saints, for these were the objects which their minds most dwelt upon; and at a later period, in Northern Europe, fairies, brownies, and Robin Goodfellows were the phantoms most frequently seen. In the Middle Ages, spectres of African negroes were common enough; but at that period no man had ever witnessed one of an American Indian, yet these, in their turn, prevailed after the voyage of Columbus. They were no strangers to our early colonial settlers.

10. One class of apparitions—those of the dead—has survived all changes of creed and superstitions, as we might reasonably suppose would be the case. But even here, as the phenomena consist merely of the emergence of old images, and new combinations of them, nothing absolutely new was ever seen in them. The Roman saw the shade of his friend clothed in the well-known toga;¹³ the European sees his in the modern garb; and the spirit of Maupertuis,¹⁴ which stood by the bay-window of the library at Berlin, had on knee-breeches, silk stockings, and shoes with large silver buckles. If these

apparitions existed elsewhere than in a diseased brain, is it not singular that, amid the awful solemnities of the other world, they should so faithfully have preserved the fashions of the present? Science is a great dispeller of superstitious fancies.

¹ IN-YŎL'-UN-TA-EY, independent of the will.

² E-RÄD'-I-CÄ-TED, rooted out; destroyed.

³ SEËC'-TRAL, having an indistinct or ghostly appearance.

⁴ DE-TË'-RI-O-RÄTE, impair; injure.

⁵ IN-OR-GÄN'-IC, without the organs or instruments of life.

⁶ GÄNG'-LI-Ä, nerve bundles.

⁷ OP'-TIC NERVE, the nerve of vision, running from the eye to the brain.

⁸ CON-TÖUR, outline of a thing.

⁹ FRIËZE, in *architecture*, a part of the entablature. See p. 282.

¹⁰ STÖ'-RIES, lofts, or sets of rooms rising one above another.

¹¹ RËT'-I-NA, the net-like membrane at the back of the eye which receives the image of external objects. See p. 83.

¹² AS-CËT'-IC, one who practices undue rigor or self-denial in religious things.

¹³ TÖ'-GA, a kind of gown.

¹⁴ MAU-PER-TUIS' (*Mo-per-wi'*), a celebrated French academician—born in 1688—died in 1759. For a long time he was president of the Royal Academy of Sciences at Berlin.

LESSON XVII.—A DREAM, AND ITS EXPLANATION.

DRAPER.

1. Not only may old impressions and ideas be so vividly recalled as to be presented to the mind with all the force of existing realities, but in this manner *dreams* are sometimes *repeated*; and although there is nothing strange in this, but what we should suppose would happen frequently, yet the ignorant often regard such phenomena as something bordering on the supernatural.¹ For the following account, given by a physician, of one of the most marvelous dreams of this character, and its explanation on physiological principles, we are indebted to the work of Dr. Draper.

2. "When I was five or six years old," says the narrator, "I dreamed that I was passing by a large pond of water in a solitary place. On the opposite side of it stood a great tree, that looked as if it had been struck by lightning; and in the pond, at another part, an old fallen trunk, on one of the prone² limbs of which was a turtle sunning himself. On a sudden a wind arose, which forced me into the pond; and in my dying struggles to extricate myself from its green and slimy waters I awoke, trembling with terror.

3. "About eight years subsequently, while recovering from a nearly fatal attack of scarlet fever, this dream presented itself to me again, identical in all its parts. Even up to this time I do not think I had ever seen a living tortoise or turtle, but I indistinctly remembered there was a picture of one in the first spelling-book that had been given me. Perhaps, on account of my critical condition, this second dream impressed me more dreadfully than the first.

4. "A dozen years more elapsed. I had become a physician, and was now actively pursuing my professional duties in one of the Southern States. It so fell out that one July afternoon I had to take a long and wearisome ride on horseback. It was Sunday, and extremely hot; the path was soli-

tary, and not a house for miles. The forest had that intense silence which is so characteristic of this part of the day; all the wild animals and birds seemed to have gone to their retreats, to be rid of the heat of the sun. Suddenly, at one point of the road, I came upon a great stagnant water-pool, and, casting my eye across it, there stood a pine-tree blasted by lightning, and on a log that was nearly even with the surface a turtle was basking in the sun. The dream of my infancy was upon me; the bridle fell from my hands; and an unutterable fear overshadowed me as I slunk away from the accursed place.

5. "Though business occasionally afterward would have drawn me that way, I could not summon the resolution to go, and actually have taken roundabout paths. It seemed to me profoundly amazing that the dream which I had twenty years before should now be realized, without respect to difference of scenery, or climate, or age. A good clergyman of my acquaintance took the opportunity of improving the circumstance to my spiritual advantage; and in his kind enthusiasm, for he knew that I had, more than once, been brought to the point of death by such fevers, interpreted my dream that I should die of marsh miasm.³

6. "Most persons have doubtless observed that they suddenly encounter circumstances or events of a trivial nature in their course of life, of which they have an indistinct recollection that they have dreamed before. It seemed for a long time to me that this was a case of that kind, and that it might be set down among the mysterious and unaccountable. How wonderful it is that we so often fail to see the simple explanation of things, when that explanation is actually intruding itself before us.

7. "And so in this case; it was long before the truth gleamed in upon me, before my reasoning powers shook off the delusive impressions of my senses. But it occurred at last, for I said to myself, 'Is it more probable that such a mystery is true', or that I have dreamed for the *third* time that which I had already dreamed of twice before'? Have I really seen the blasted tree and the sunning turtle'? Are a weary ride of fifty miles, the noontide heat, the silence that could almost be felt, no provocatives⁴ of a dream'? I have ridden, under such circumstances, many a mile, fast asleep, and have awoke and known it—and so I resolved that if ever circumstances carried me to those parts again, I would satisfy myself as to the matter.

8. "Accordingly, when, after a few years, an incident led me to travel there, I revisited the well-remembered scene. There still was the stagnant pool, but the blasted pine-tree was gone; and, after I had pushed my horse through the marshy thicket as far as I could urge him, and then dismounted and pursued a close investigation on foot in every direction round the spot, I was clearly convinced that no pine-tree had ever grown there; not a stump, nor any token of its remains, could be seen; and so now I have concluded that, at the glimpse of the water, with the readiness of those who are falling asleep I had adopted an external fact into a dream; that it had aroused the trains of thought which, in former years, had occupied me; and that, in fine, the mystery was all a delusion, and that I had been frightened with less than a shadow."

9. The instructive story of this physician teaches us how readily, and yet how impressively, the remains of old ideas may be recalled; how they may, as it were, be projected⁵ into the space beyond us, and take a position among existing re-

alities. That such images arise from a physical impression which has formerly been made in the registering ganglia of the brain, it is impossible to doubt; and it is philosophical to suppose that, for their emergence⁶ from their dormant⁷ state, it is only necessary that there should be a dulling or blunting of the sensations which we are in the act of receiving from external sources, so that these latent⁸ relics, laid up in the brain, may present themselves with at least equal force.

¹ SU-PER-NĀT'-Ū-RAL, above or beyond the laws of nature; miraculous.

² PRŌNE, bending downward.

³ MĪ'-ASM, noxious vapors or effluvia.

⁴ PRO-VŪ'-CA-TIVE, that which excites or leads to.

⁵ PRO-JĒCT'-ED, thrust forward.

⁶ E-MĒR'-GENCE, a coming forth.

⁷ DŌR'-MANT, sleeping.

⁸ LĀ'-TENT, not visible; concealed.

LESSON XVIII.—THE HEALTH OF THE BRAIN.

1. **ALTHOUGH** the brain is the seat of thought, of feeling, and of consciousness, it is nevertheless a part of the animal system. Do not make a mistake in supposing that the brain is the mind itself. It is merely the organ of the mind—the medium through which the mind acts. In like manner, *speech* is not thought itself; it is merely an instrument by which thought is conveyed from one mind to another.

2. The brain is subject to the same general laws of health as the other bodily organs; and, like them, it is liable to disease. It is nourished by the blood; it is strengthened by mental exercise; it is injured by over-exertion; and it is enfeebled by disease. When the mind thinks intently, an increased quantity of blood is sent to the brain to supply the waste of material occasioned by exercise of that organ. The brain is then enlarged in bulk; and hence we see the danger of too long continued intense application, which often results in congestion¹ of the brain, apoplexy,² and death. So, also, if the brain be highly excited by the excessive use of stimulants, a rush of blood to the brain will be the consequence, and the mind will be disturbed; and if, on the other hand, the *mind* be suddenly roused by violent passions, the vessels of the brain will instantly be excited to increased action, redness will suffuse the face, and the disturbance will be the same as if produced by a physical cause.

3. Although the weight of the brain is only about one fortieth of the weight of the body, yet ordinarily about one sixth of all the blood is sent to this organ. If more than the usual quantity be sent there, as will happen in cases of intense and

long-continued mental exertion, it will circulate but feebly in other parts, and hence the feet will become cold, the stomach will act slowly, and active muscular exercise can not be taken with profit; and when, on the other hand, other parts of the body require a bountiful supply of blood, as is the case when the stomach is engaged in the process of digestion, and when the muscles generally are called into vigorous action, the brain will be incapable of its greatest efforts. Hence severe mental application should never be attempted just before or after a hearty meal, nor during any active muscular exertion.

4. Keeping in view that the brain is a bodily organ, and that *thought* is its proper stimulus to exertion—that, like an arm in a sling, it dwindles by disuse, and becomes slow and feeble in its movements, we shall not be surprised to find that inactivity of intellect is a frequent predisposing cause of every form of nervous disease. We witness the truth of this in the well-known fact that solitary confinement is so severe a punishment, even to the strongest minds, as often to produce permanent derangement of intellect, and even confirmed idiocy; and it is a lower degree of the same cause which renders continuous seclusion from society so injurious to both mental and bodily soundness. We also see the effects of want of mental occupation in the numerous victims to nervous disease among females of the middle and higher ranks, who, having no calls to exertion in gaining the means of subsistence, and no objects of interest on which to exercise their mental faculties, sink into a state of mental sloth and nervousness, which not only deprives them of much enjoyment, but subjects them to suffering both of body and mind from the slightest causes.

5. An additional illustration, and a very common one, of the bad effects of want of mental occupation, is often presented in the case of a man of mature age and active habits, who, having devoted his life to the toils of business, and having acquired a competency,³ gives up all his business relations, and retires to the country to seek repose and enjoyment. Suppose such a person to have no moral, religious, or philosophical pursuits to occupy his attention and keep up the active exercise of his brain; this organ will lose its health from inaction, and the inevitable result will be, weariness of life, despondency, melancholy, or some other form of nervous disease. Long confinement to an unvarying round of employment, which affords neither scope nor stimulus for one half of the faculties, must also be prejudicial to the health and vigor of the nervous system.

6. But the evils arising from excessive or ill-timed exercise of the brain are also numerous, and equally in accordance with the ordinary laws of physiology. When we use the eye too long, or in too bright a light, it becomes bloodshot; and if we continue to look intently, the irritation at length becomes permanent, and disease, followed by weakness of sight, or even blindness, may ensue. Phenomena precisely analogous⁴ occur when, from intense mental excitement, the brain is kept long in excessive activity. We learn this from occasional cases in which, from some external injury, the brain has been so exposed that its action has been seen.

7. Sir Astley Cooper had a young gentleman brought to him who had lost a portion of his skull just above the eye-brow. "On examining the head," says Sir Astley, "I distinctly saw the pulsation of the brain was regular and slow; but at this time he was agitated by some opposition to his wishes, and directly the blood was sent with increased force to the brain, and the pulsation became frequent and violent." Who does not know that when one is moderately flushed and heated in debate his mind works more freely and powerfully than at any other time? And why? Because then his brain has a healthy activity, occasioned by an abundant supply of its natural stimulus. But let the excitement run too high, and too much blood be sent to the brain, and giddiness will ensue, threatening apoplexy; or the brain may be overstrained, the same as an arm, and the consequence be permanent mental debility.

¹ CON-GĒS'-TION, too great an accumulation of blood.

ducing loss of sense and voluntary motion.

² ĀP'-O-PLEX-Y, a disorder of the brain pro-

³ CŌM'-PE-TEN-CY, a sufficiency of property.

⁴ A-NĀL'-O-GOUS, like; similar.

LESSON XIX.—THE FOOT'S COMPLAINT.

1. "It's really too bad," cried the Foot in a fever,
"That I am thus walking and walking forever:
My mates are to honor and indolence thrust,
While here I am doomed to the mud and the dust.
2. "There's the Mouth—he's the fellow for all the nice things,
And the Ear only wakes when the dinner-bell rings;
The Hand with his rings decks his fingers so white;
And as to the Eye—he sees every fine sight."
3. "Stay, stay," said the Mouth; "don't you know, my dear brother,
We all were intended to help one another?
And surely *you* can't be thought useless and mean,
On whom all the rest so entirely must lean'.

4. "Consider', my friend', we are laboring too',
And toiling—nay, don't interrupt me—for you';
Indeed, were it not for the Hand, Mouth, and Eye,
Of course, you know well, you would falter and die.
5. "I eat, but 'tis only that you may be strong;
The Hand works for you', friend', all the day long';
And the Eye—he declares he shall soon lose his sight,
So great are his efforts to guide you aright."
6. The Foot, in reply, could find nothing to say,
For he felt he had talked in a culpable way,
And owned the reproof was both wise and well-meant—
For, wherever we are, we should there be content.

Anonymous.

LESSON XX.—RULES FOR MENTAL EXERCISE.

1. At any time of life excessive and long-continued mental exertion is hurtful, but especially in infancy and early youth, when the structure of the brain is still immature and delicate.

2. While the healthy and backward boy may, without danger, be stimulated to mental exertion, the delicate and precocious child needs constant mental restraint, and much out-door exercise.

3. Cheerful feelings, as they exert an enlivening influence over the whole system, conduce greatly to a healthy activity of the brain, and increase its power for exertion.

4. The growing child requires more sleep than the adult; and the close student more than the idler. In proportion as mental excitement is opposed to sleep, it exhausts the body.

5. The length of time the brain may be safely used is modified by many circumstances, such as those of age, mental habits, health of the brain, and health of the system. If the brain has long been habituated to profound study, it will not be so soon fatigued as when its habits have been indolent.

6. The brain finds relief from exhaustion in frequent change of studies and occupation. The early part of the day, when the exhausted energies of body and mind have been restored by repose, is the best time for study.

7. As quiet of the brain is essential to quiet sleep', active study should cease some time before retiring to rest.

8. We should not enter upon continued mental exertion', or arouse deep feeling, immediately before or after violent muscular exercise.

9. Moderate mental exertion is more necessary in old age than in mature years. In middle life, while the body is gaining strength, the exhaustion of the brain from overexcitement may be repaired; but no such result follows overexertion in the decline of life. The current history of the day furnishes numerous sad examples of premature death from overtasked brains at an advanced period of life.

10. The physical, intellectual, and moral faculties should receive, daily, their appropriate share of culture, that all may grow in harmony together. Just in proportion as mind is cultivated in some one direction only, the result is that species of monomania which we see in *men of one idea*; and when the physical alone is cultivated, we have the mere bully or bravado.

11. When the brain is overcharged with blood, as often occurs from too

great mental exertion, or from disease or accident, the most ready and safe means of relief is to make warm applications to the feet and hands, which will tend to draw the blood from the brain to the extremities.

12. Exercise is as natural to the mind as to the body; hence all healthy children delight in constant mental occupation; and if they can not obtain it in judicious mental culture and honest employment, they will be apt to seek it in the haunts of dissipation, and perhaps in those of crime. It is a *physiological* as well as a moral truth, that "Idleness is the parent of vice;" and it is no less the teaching of physiology than of experience, that, if we will not educate the ignorant, we may expect to support them as paupers or criminals.

LESSON XXI.—ADVICE TO A HARD STUDENT.

"Seek variety in recreation and study."

1. STILL vary thy incessant task,
Nor plod each weary day,
As if thy life were thing of earth—
A servant to its clay.
Alternate¹ with thy honest work
Some contemplations high¹:
Though toil be just', though gold' be good',
Look upward' to the sky¹.
2. Take pleasure for thy limbs at morn';
At noontide wield the pen';
Converse to-night with moon and stars';
To-morrow' talk with men.
Cull garlands in the fields and bowers,
Or toy with running brooks;
Then rifle² in thy chamber lone
The honey of thy books.
3. If in the wrestlings of the mind
A gladiator strong',
Give scope and freedom to thy thought—
But strive not over long.
Climb to the mountain-top serene,
And let life's surges beat,
With all their whirl of striving men,
Far, far beneath thy feet.
4. But stay not ever on the height,
Mid intellectual snow;
Come down betimes to tread the grass,
And roam where waters flow;
Come down betimes to rub thy hands
At the domestic hearth';³
Come down to share the warmth of love',
And join the children's mirth¹.
5. Let love of books', and love of fields',
And love of men combine

To feed in turns thy mental life,
 And fan its flame divine¹;
 Let outer frame, and inner soul',
 Maintain a balance true',
 Till every string on Being's lyre
 Give forth its music due.—CHARLES MACKAY.

¹ AL-TÛR'-NÂTE, or ÂL'-TEE-NÂTE, to ex-³ HEÆTH (*hæth*). This is the approved
 change; perform by turns. pronunciation, although the writer, above,
² RÛ'-FLE, seize and bear away. makes it rhyme with *nirth*.

LESSON XXII.—NEGLECT OF HEALTH.

SAMUEL JOHNSON.

1. THERE is among the fragments of the Greek poets a short hymn to Health, in which her power of exalting the happiness of life, of heightening the gifts of fortune, and adding enjoyment to possession, is inculcated with so much force and beauty that no one, who has ever languished under the discomforts and infirmities of a lingering disease, can read it without feeling the images dance in his heart, and adding, from his own experience, new vigor to the wish, and from his own imagination new colors to the picture. The particular occasion of this little composition is not known, but it is probable that the author had been sick, and in the first raptures of returning vigor addressed Health in the following manner:

2. "Health, most venerable of the powers of heaven! with thee may the remaining part of my life be passed, nor do thou refuse to bless me with thy residence. For whatever there is of beauty or of pleasure in wealth, in descendants, or in sovereign command, the highest summit of human enjoyment, or in those objects of human desire which we endeavor to chase into the toils of love; whatever delight, or whatever solace is granted by these celestials, to soften our fatigues, in thy presence, thou parent of happiness, all those joys spread out, and flourish; in thy presence blooms the spring of pleasure, and without thee no man is happy."

3. Such is the power of health, that without its co-operation every other comfort is torpid and lifeless, as the powers of vegetation without the sun. And yet this bliss is often thrown away in thoughtless negligence, or in foolish experiments on our own strength; we let it perish without remembering its value, or waste it to show how much we have to spare; it is sometimes given up to the management of levity and chance, and sometimes sold for the applause of jollity and debauchery.

4. Health is equally neglected, and with equal impropriety, by the votaries of business and the followers of pleasure. Some men ruin the fabric of their bodies by incessant revels, and others by intemperate studies; some batter it by excess, and others sap it by inactivity. Yet it requires no great ability to prove that he loses pleasure who loses health; and that health is certainly of more value than money, because it is by health that money is procured, and by health alone that money is enjoyed:

5. Nor love, nor honor, wealth, nor power,
Can give the heart a cheerful hour
When health is lost. Be timely wise;
With health all taste of pleasure flies.—GAY.

6. Ah! what avail the largest gifts of Heaven,
When drooping health and spirits go amiss?
How tasteless then whatever can be given!
Health is the vital principle of bliss,
And exercise of health. In proof of this,
Behold the wretch who slugs his life away,
Soon swallowed in disease's sad abyss,
While he whom toil has braced, or manly play,
Has light as air each limb, each thought as clear as day:

7. Oh, who can speak the vigorous joy of health—
Unclogged the body, unobscured the mind?
The morning rises gay, with pleasing stealth,
The temperate evening falls serene and kind.
In health the wiser brutes true gladness find.
See! how the younglings frisk along the meads,
As May comes on and wakes the balmy wind;
Rampant with life, their joy all joy exceeds:
Yet what but high-strung health this dancing pleasure breeds.—THOMSON.

8. Health is indeed so necessary to all the duties, as well as pleasures of life, that the crime of squandering it is equal to the folly; and he that for a short gratification brings weakness and diseases upon himself, and for the pleasure of a few years passed in the tumults of diversion and clamors of merriment condemns the maturer and more experienced part of his life to the chamber and couch, may be justly reproached, not only as a spendthrift of his own happiness, but as a robber of the public—as a wretch that has voluntarily disqualified himself for the business of his station, and refused that part which Providence assigns him in the general task of human nature.

THIRD MISCELLANEOUS DIVISION.



LESSON I.—THE VILLAGE SCHOOL OF OLDEN TIME.

[The reading of this inimitable piece of description, in which the most delicate satire is conveyed under the guise of profound admiration, requires, especially in the third verse, the ironical tone of mock laudation and respect.]

1. Beside yon straggling fence that skirts the way
 With blossom'd furze! unprofitably gay—
 There', in his noisy mansion', skill'd to rule',
 The village master taught his little school'.
2. A man *severe* he was', and *stern* to view';
 I knew him well, and every truant knew:

Well had the boding tremblers learned to trace
 The day's disasters in his morning face¹;
 Full well they laugh'd, with counterfeited glee,
 At all his jokes, for many a joke had he¹:
 Full well the busy whisper, circling round,
 Convey'd the dismal tidings when he frown'd¹:
 Yet he was kind¹, or if severe in aught¹,
 The love he bore to *learning* was in fault¹.

3. The village all declared how much he knew;
 'Twas certain¹ he could write¹, and cipher¹ too;
Lands he could measure¹, *terms*² and *tides* presage¹; ³
 And e'en the story ran that he could *gauge*¹.⁴
 In *arguing*, too, the parson own'd his skill,
 For e'en though *vanquished* he could argue still¹;
 While words of learned length and thundering sound
 Amazed the gazing rustics ranged around—
 And still they gazed¹, and still the wonder grew¹,
 That one small head could carry all he knew.

GOLDSMITH.

¹ *FURZE*, a beautiful evergreen shrub, with brilliant yellow flowers, abundant on the English commons.
² *TERMS*, probably here referring to the terms or *times* when the courts were to be held.
³ *PRE-SÄGE*¹, foreshow; predict.
⁴ *GÄUGE* (*gäp*), to measure the contents of a cask, barrel, or other vessel.

LESSON II.—THE RIGHTEOUS NEVER FORSAKEN.

1. It was Saturday night, and the widow of the Pine Cottage sat by her blazing fagots, with her five tattered children at her side, endeavoring, by listening to the artlessness of their prattle, to dissipate the heavy gloom that pressed upon her mind. For a year, her own feeble hands had provided for her helpless family, for she had no supporter, no friend to whom to apply, in all the wide, unfriendly world around. That mysterious Providence, the wisdom of whose ways is above human comprehension, had visited her with wasting sickness, and her little means had become exhausted. It was now, too, mid-winter, and the snow lay heavy and deep through all the surrounding forests, while storms still seemed gathering in the heavens, and the driving wind roared amid the bounding pines, and rocked her puny mansion.

2. The last herring smoked upon the coals before her; it was the only article of food she possessed, and no wonder her forlorn, desolate state brought up in her lone bosom all the anxieties of a mother, when she looked upon her children; and no wonder, forlorn as she was, if she suffered the heart-swellings of despair to rise, even though she knew that He whose promise is to the widow and to the orphan can not for-

get his word. Providence had many years before taken from her her eldest son, who went from his forest home to try his fortune on the high seas, since which she had heard no note or tidings of him; and in latter time, by the hand of death, she had been deprived of the companion and staff of her earthly pilgrimage in the person of her husband. Yet to this hour she had been upborne; she had not only been able to provide for her little flock, but had never lost an opportunity of ministering to the wants of the miserable and destitute.

3. The indolent may well bear with poverty while the ability to gain sustenance remains. The individual who has but his own wants to supply may suffer with fortitude the winter of want; his affections are not wounded, his heart not wrung. The most desolate in populous cities may hope, for charity has not quite closed her hand and heart, and shut her eyes on misery. But the industrious mother of helpless and depending children, far from the reach of human charity, has none of these to console her. And such a one was the widow of the Pine Cottage; but as she bent over the fire, and took up the last scanty remnant of food to spread before her children, her spirits seemed to brighten up, as by some sudden and mysterious impulse, and Cowper's beautiful lines came uncalled across her mind:

"Judge not the Lord by feeble sense,
But trust him for his grace;
Behind a frowning Providence
He hides a smiling face."

4. The smoked herring was scarcely laid upon the table when a gentle rap at the door, and loud barking of a dog, attracted the attention of the family. The children flew to open it, and a weary traveler, in tattered garments, and apparently indifferent health, entered and begged a lodging and a mouthful of food; said he, "it is now twenty-four hours since I have tasted bread." The widow's heart bled anew as under a fresh complication of distresses; for her sympathies lingered not round her fireside. She hesitated not, even now; rest, and share of all she had, she proffered to the stranger. "We shall not be forsaken," said she, "or suffer deeper for an act of charity."

5. The traveler drew near the board; but when he saw the scanty fare, he raised his eyes toward Heaven with astonishment, "And is this *all* your store?" said he; "and a share of this do you offer to one you know not? then never saw I *charity* before! But, madam," said he, continuing, "do you not wrong your *children* by giving a part of your last mouth-

ful to a stranger?" "Ah!" said the poor widow, and the tears gushed into her eyes as she said it, "I have a *boy*, a darling *son*, somewhere on the face of the wide world, unless Heaven has taken him away, and I only act toward you as I would that others should act toward him'. God, who sent manna from heaven, can provide for us as he did for Israel; and how should I this night offend Him, if my son should be a wanderer, destitute as you, and he should have provided for him a home, even poor as this, were I to turn you unrelieved away."

6. The widow ended, and the stranger, springing from his seat, clasped her in his arms: "God indeed has provided your son a home, and has given him wealth to reward the goodness of his benefactress—my mother! oh, my mother!"

7. It was her long-lost son, returned to her bosom from the Indies. He had chosen that disguise that he might the more completely surprise his family; and never was surprise more perfect, or followed by a sweeter cup of joy. That humble residence in the forest was exchanged for one comfortable, and indeed beautiful, in the valley; and the widow lived long with her dutiful son, in the enjoyment of worldly plenty, and in the delightful employments of virtue; and at this day the passer-by is pointed to the willow that spreads its branches above her grave.—*New York Spectator*.

LESSON III.—THE FAMILY MEETING.

[The reading of this piece requires a slow delivery, with much pathetic tenderness.]

1. WE are all here!
 Father', mother', sister', brother',
 All who hold each other dear.
 Each chair is fill'd': we're all at home':
 To-night, let no cold stranger come':
 It is not often thus' around
 Our old familiar hearth we're found':
 Bless then the meeting and the spot';
 For once', be every care forgot';
 Let gentle Peace assert her power,
 And kind Affection rule the hour';
 We're all—all here,
2. We're not all here!
 Some are away'—the dead' ones dear,
 Who throng'd with us this ancient hearth,
 And gave the hour to guiltless mirth.
 Fate, with a stern relentless hand,
 Look'd in and thinn'd our little band':

Some', like a night-flash, pass'd away',
 And some' sank lingering day by day';
 The quiet grave-yard'—some' lie there—
 And cruel Ocean has *his*' share :
 We're *not*' all here.

3. We *are*' all here !
 Even *they*', the *dead*'—though dead', so dear,
 Fond Memory, to her duty true,
 Brings back *their*' faded forms to view.
 How life-like through the mist of years,
 Each well-remember'd face appears' !
 We see them as in times long past,
 From each to each kind looks are cast ;
 We hear their *words*', their *smiles*' behold,
 They're round us', as they were of old'—
 We *are*' all here !

4. We are all here' !
 Father', mother', sister', brother',
 You that I love with love so dear'.
 This may not long of us be said ;
 Soon must we join the gather'd dead,
 And by the hearth we now sit round,
 Some *other* circle will be found.
 Oh ! then, that wisdom may we know,
 Which yields a life of peace below :
 So, in the world to follow this,
 May each repeat, in words of bliss,
 We're *all*'—*all*'—*here*' !

CHARLES SPRAGUE.

LESSON IV.—TACT AND TALENT.

[This Lesson furnishes fine examples of contrasted or antithetic clauses, for the reading of which see Rule VI., and also what is said on the same subject on page 27. It also furnishes several fine examples of *concluding series*, etc. See page 15.]

1. *TALENT*' is something', but *tact*' is every' thing. *Talent*' is serious', sober', grave', and respectable' : *tact*' is all that', and more too'. It is not a sixth sense', but it is the life of all the five'. It is the open eye', the quick ear', the judging taste', the keen smell', and the lively touch' ; it is the interpreter of all riddles', the surmounter of all difficulties', the remover of all obstacles'. It is useful in all places', and at all times' ; it is useful in solitude', for it shows a man his way *into*' the world ; it is useful in society', for it shows him his way *through*' the world.

2. *Talent*' is power', *tact*' is skill' ; *talent*' is weight', *tact*' is momentum' ; *talent*' knows *what*' to do, *tact*' knows *how*' to do it ; *talent*' makes a man respectable', *tact*' will make

him respected'; talent' is wealth', tact' is ready money.' For all the practical purposes of life', tact carries it against talent, ten to one. Take them to the theatre', and put them against each other on the stage', and talent' shall produce you a tragedy that will scarcely live long enough to be condemned', while tact' keeps the house in a roar, night after night, with its successful arces. There is no want of dramatic talent', there is no want of dramatic tact'; but they are seldom together': so we have successful pieces which are not respectable', and respectable pieces which are not successful'.

3. Take them to the bar, and let them shake their learned curls at each other in legal rivalry; talent' sees its way clearly, but tact' is first at its journey's end. Talent' has many a compliment from the bench, but tact' touches fees from attorneys and clients. Talent' speaks learnedly and logically, tact' triumphantly. Talent' makes the world wonder that it gets on no faster, tact' excites astonishment that it gets on so fast. And the secret is, that it has no weight' to carry; it makes no false steps'; it hits the right nail on the head'; it loses no time'; it takes all hints'; and by keeping its eye on the weathercock', is ready to take advantage of every wind that blows'. Take them into the church. Talent' has always something worth hearing', tact' is sure of abundance' of hearers; talent' may obtain a living, tact' will make one; talent' gets a good name, tact' a great one; talent' convinces', tact' converts'; talent' is an honor *to*' the profession, tact' gains honor *from*' the profession.

4. Take them to court. Talent' feels its weight', tact' finds its way'; talent' commands', tact' is obeyed'; talent' is honored with approbation', and tact' is blessed by preferment'. Place them in the senate. Talent' has the ear of the house', but tact' wins' its heart', and has' its votes'; talent' is fit for employment', but tact' is fitted for' it. It has a knack of slipping into place with a sweet silence and glibness of movement, as a billiard ball insinuates itself into the pocket. It seems to know every thing', without learning any' thing. It has served an invisible and extemporaneous apprenticeship'; it wants no drilling'; it never ranks in the awkward squad'; it has no left hand', no deaf ear', no blind side'. It puts on no looks of wondrous wisdom', it has no air of profundity', but plays with the details of place as dexterously as a well-taught hand flourishes over the keys of the piano-forte. It has all the air of commonplace', and all the force and power of genius.—*London Atlas.*

LESSON V.—RAIN UPON THE ROOF.

[The following beautiful lines require great tenderness and delicacy of expression in the reading, to be in harmony with the tender and subdued feeling which the scene represented is so well calculated to produce.]

1. WHEN the humid storm-clouds gather
 Over all the starry spheres',
 And the melancholy darkness
 Gently weeps in rainy tears',
 'Tis a joy to press the pillow
 Of a cottage-chamber bed',
 And to listen to the patter
 Of the soft rain over head.
2. Every tinkle on the shingles'
 Has an echo in the heart',
 And a thousand lively fancies'
 Into busy being start';
 And a thousand recollections
 Weave their bright hues into woof,
 As I listen to the patter
 Of the rain upon the roof.
3. There, in fancy, comes my mother,
 As she used to, years ago,
 To survey the infant sleepers,
 Ere she left them till the dawn.
 I can see her bending o'er me,
 As I listen to the strain
 Which is played upon the shingles
 By the patter of the rain.
4. Then my little seraph sister',
 With her wings and waving hair',
 And her bright-eyed cherub brother',
 A serene, angelic pair',
 Glide around my wakeful pillow,
 With their praise or mild reproof',
 As I listen to the murmur
 Of the soft rain on the roof.
5. There is naught in art's bravuras¹
 That can work with such a spell,
 In the spirit's pure, deep fountains,
 Whence the holy passions swell,
 As that melody of nature',
 That subdued, subduing strain',
 Which is played upon the shingles'
 By the patter of the rain'.

Anonymous.

¹ *DeX-vû'-ra*, a spirited, brilliant song or air, for the display of execution.

LESSON VI.—GOOD ADVICE.

1. A CERTAIN khan of Tartary, traveling with his nobles, was met by a dervis, who cried, with a loud voice, "Whoever will give me a hundred pieces of gold, I will give him a piece of advice." The khan ordered the sum to be given to him, upon which the dervis said, "*Begin nothing of which thou hast not well considered the end.*" The courtiers, hearing this plain sentence, smiled, and said, with a sneer, "The dervis is well paid for his maxim." But the khan was so well pleased with the answer, that he ordered it to be written in golden letters in several parts of his palace, and engraved on all his plate.

2. Not long after, the khan's surgeon was bribed to kill him with a poisoned lancet, at the time he bled him. One day, when the khan's arm was bound, and the fatal lancet in the hand of the surgeon, the latter read on the basin, "*Begin nothing of which thou hast not well considered the end.*" He immediately started, and let the lancet fall out of his hand. The khan, observing his confusion, inquired the reason; the surgeon fell prostrate, confessed the whole affair, and was pardoned; but the conspirators were put to death. The khan, turning to his courtiers, who had heard the advice with disdain, told them that the counsel could not be too highly valued which had saved a khan's life.

LESSON VII.—TRUE KNOWLEDGE.

What is *true knowledge*? Is it with keen eye
Of lucre's sons to thread the mazy way?
Is it of civic rights, and royal sway,
And wealth political, the depths to try?
Is it to delve the earth, or soar the sky;
To mix, and analyze, and mete, and weigh
Her elements, and all her powers descry?
These things', who will may know' them, if to know'
Breed not vain-glory': but o'er all to scan
God, in his works and word shown forth below—
Creation's wonders, and Redemption's plan,
Whence came we, what to do, and whither go—
This is *true knowledge*, and the "whole of man."

BISHOP MANT.

PART IV.

SECOND DIVISION OF BOTANY.

[This subject is continued from the Fourth Reader.]



LESSON I.—THE STUDY OF BOTANY.

1.

Lo! when the buds expand, the leaves are green,
Then the first opening of the flower is seen;
Then come the humid breath and rosy smile,
That with their sweets the willing sense beguile;
But as we look, and love, and taste, and praise,
And the fruit grows, the charming flower decay. ;
Till all is gathered, and the wintry blast
Mourns o'er the place of love and pleasure past.—CRABBE.

2. The changes described by the poet are indeed full of interest and beauty, from the time when "the buds expand," and "the leaves are green," till the once bright foliage falls brown and withered before "the wintry blast." There are few, perhaps, who are totally insensible to these changes in their general manifestations; but few, too few, have their minds awakened to the succession of beautiful and varied forms which year by year adorn our fields and woods—nay, even our hedges and ditches; too few of those who have ample opportunity and leisure know, even by sight, much less by name, our commonest wild flowers; and yet there is not one of these, from the humblest weed that grows, that will not yield abundant scope for study—that does not exhibit perfection and beauty of structure that tell of its Divine Creator.

3. Nothing, perhaps, astonishes an individual more, when commencing the search for and study of our uncultivated plants, than to find, even in the most commonplace walk, what an immense variety of different kinds—species, as they are called botanically—he has, day by day, trodden under foot, without an idea of their existence. Interest succeeds astonishment; he finds a new source of pleasure opened to him, and one which gives not only pure and healthy thoughts to the mind, but health to the body, by affording inducements to exercise, and adding to the latter that excitement which gives it a tenfold value.

4. Few pursuits in which the mind can engage are purer, or have more tendency to afford innocent and happy thoughts, than the study of flowers generally; and though it may be some advantage to possess gardens and conservatories¹ well stocked with the gorgeous natives of other climates, the mere contemplation of these can never bring half the pleasurable excitement which the search after the wild plants of our own country affords to the zealous collector and student. The former are the privileges of the rich, the latter are open to the poorest in the land—

“A blessing given
E'en to the poorest little one
That wanders 'neath the vault of heaven.”

¹ CON-SERV'-A-TO-RY, a green-house for exotic (foreign) plants.

LESSON II.—CLASSIFICATION OF PLANTS.

“The Almighty Maker has, throughout,
Discriminated each from each, by strokes
And touches of his hand, with so much art
Diversified, that two were never found
Twins at all points.”

1. CLASSIFICATION in botany is the process by which plants are distributed into divisions, classes, genera or families, species, and varieties. Dictionaries are so arranged that a person can easily find any word in the language; and in a manner somewhat similar he can find a description of any known plant in a botanical dictionary or *flora*. The number of different kinds or species of plants is about one hundred thousand, and it is a very important matter to arrange them in the most convenient manner for reference.

2. It will occur to the reader that plants should be classified by their resemblances; and it may seem to be an easy task, thus to arrange them; but those who have attempted it have

encountered many difficulties. Plants that at first sight appear very much alike will often be found to differ widely; and those which seem unlike will have many things that agree.

3. A humming-bird, flitting from flower to flower, seems to resemble the butterfly of variegated wing; but the naturalist considers the humming-bird more like an elephant than a butterfly. He will call the bird and elephant *vertebrate* animals, and will show a striking resemblance between the skeleton of the tiny wing of the one and the huge leg of the other.

4. As a scientific arrangement of plants requires an intimate acquaintance with the form, structure, and properties of a hundred thousand species, we can well understand why a correct classification was impossible in the infancy of the science. Some early writers attempted to arrange plants according to the alphabetical order of their names; others took for their guide the structure of their roots; another class only regarded the form of the leaves; while others considered the time of flowering, the place of growth, or medicinal properties. Two hundred years ago the poet Cowley published an arrangement of plants founded on their size and appearance. Herbs, flowers, and trees were his divisions; which Hugh Miller has said was like Buffon's division of animals into *wild* and *tame*.

5. Many methods of classification have been proposed within the last two centuries, but they have gradually given place to the *artificial* system of Linnæus, and the *natural* method of Jussieu. The former divided the vegetable world into twenty-four *CLASSES*, by characteristics depending on the number, position, length, or union of the *stamens*; and these classes he then subdivided into *ORDERS*, founded mostly on peculiarities of the *pistils*. A synopsis of the *twenty-one* classes in which American botanists have arranged plants on the Linnæan method, is here given.* As the "Natural Method," however, is the one now most approved by botanists, we have adopted that arrangement in our treatment of the subject.

6. The naming and classifying of plants was the delightful task of Eve in Paradise, according to Milton, who represents her as saying,

"O, flowers,
That never will in other climate grow,
My earliest visitation, and my last
At even, which I bred up with tender hand

* SYNOPSIS OF THE ARTIFICIAL OR LINNÆAN SYSTEM.

As the 11th, 18th, and 23d classes of Linnæus comprise but few genera found in the United States, and those variable in their characters, most American botanists have distributed them among the other classes, an arrangement which we have adopted in this synopsis, and in our references to the Linnæan system. See next page.

From the first opening bud, and gave ye names!
 Who now shall rear ye to the sun, or rank
 Your tribes, and water from the ambrosial fount?"

LESSON III.—NATURAL METHOD OF CLASSIFICATION.

It is pleasant to note all plants, from the rush to the spreading cedar,
 From the giant king of palms to the lichen that staineth its stem.—TUPPER.

1. The primary and most obvious division of the vegetable kingdom is into two great series or classes, **FLOWERING*** and



First Class, **MONANDRIA**, has *one* stamen.

Examples: ginger, arrow-root, samphire, starwort, etc.

Second Class, **DIANDRIA**, has *two* stamens.

Ex.: lilac, jessamine, sage, caltapa, fringe-tree, rosemary, etc.

Third Class, **TRIANDRIA**, has *three* stamens.

Ex.: gladiolus, iris, crocus, millet, chess, wheat, etc.

Fourth Class, **TETRANDRIA**, has *four* stamens.

Ex.: holly, partridge-berry, Venus'-pride, teasel, madder, etc.

Fifth Class, **PENTANDRIA**, has *five* stamens.

Ex.: potato, mullein, flax, violet, four-o'clock, comfrey, etc.

Sixth Class, **HEXANDRIA**, has *six* stamens.

Ex.: lily, hyacinth, jonquil, snow-drop, spider-wort, etc.

Seventh Class, **HEPTANDRIA**, has *seven* stamens.

Ex.: chick-wintergreen, horse-chestnut, little buckeye, etc.

Eighth Class, **OCTANDRIA**, has *eight* stamens.

Ex.: cranberry, nasturtion, buckwheat, fuchsia, maple, etc.

Ninth Class, **ENNEANDRIA**, has *nine* stamens.

Ex.: sassafras, rhubarb, spice-bush, erigonum, etc.

Tenth Class, **DECAENDRIA**, has *ten* stamens.

Ex.: trailing arbutus, whortleberry, pink, cassia, Venus' fly-trap, etc.

Eleventh Class, **ICOSANDRIA**, has *over ten* stamens, on the calyx.

Ex.: rose, cherry, myrtle, raspberry, plum, peach, etc.

Twelfth Class, **POLYANDRIA**, has *over ten* stamens, on the receptacle.

Ex.: poppy, peony, pond-lily, bloodroot, orange, etc.

Thirteenth Class, **DIDYNAMIA**, has *four* stamens, two longer than the others.

Ex.: lavender, hyssop, balm, mint, foxglove, etc.

Fourteenth Class, **TETRADYNAMIA**, has *six* stamens, four longer than the others.

Ex.: cabbage, mustard, etc.

Fifteenth class, **MONADELPHIA**, stamens united in *one* tube.

Ex.: hollyhock, mallows, cotton, geranium, cranebill, etc.

Sixteenth Class, **DIADELPHIA**, stamens united in *two* sets.

Ex.: pea, bean, vetch, locust, indigo, clover, lupine, etc.

Seventeenth Class, **SYNGENESIA**, anthers united, flowers compound.

Ex.: daisy, dandelion, aster, lettuce, tansy, sunflower, etc.

Eighteenth Class, **GYNANDRIA**, stamens on the pistil.

Ex.: ladies'-slipper, snakeroot, orchis, milk-weed, arethusa, etc.

Nineteenth Class, **MONECIA**, stamens and pistils in different flowers on the same plant.

Ex.: Indian corn, nettles, etc.

Twentieth Class, **DICECIA**, stamens and pistils on different plants.

Ex.: willow, poplar, ash, hop, hemp, yew, etc.

Twenty-first Class, **CRYPTOGAMIA**, flowerless plants.

Ex.: ferns, mosses, lichens, mushrooms, puff-balls, sea-weed, etc.



11th order has 12 styles, and the 12th more founded upon the covering or the nakedness of the seeds; and in the 17th upon peculiarities in the *florets*.

The **ORDERS** of the first ten, and 15th, 16th, 18th, 19th, and 20th classes are determined by the number of *styles* (or stigmas when the styles are wanting) in each flower. The than 12. The orders in the 13th class are of the seeds; and in the 17th upon peculiarities in the *florets*.

* Called by botanists *Phenogamous* plants.

FLOWERLESS^b plants. Next is a subdivision of the former into the *exogenous*,^c or outside growers, and the *endogenous*,^d or inside growers, whose leading characteristics of seed, stem, and leaf have already been noticed in the article on Botany, in the Fourth Reader.

2. A very large proportion of the exogenous plants have their seeds covered in various ways, some being inclosed in little boxes or chests, called pericarps and capsules, some in pods, and others in the centre of the fruit, as in apples, peaches, and pears. A few of the exogenous plants, however, of which the pines, the firs, and the yews are the representatives, differ from all the rest in having their seeds naked. Thus Nature has formed two great divisions of the exogenous plants; and we may designate them as those which have *covered seeds*,^e and those which have *naked seeds*.^f

3. The endogenous plants, which are only about one fifth as numerous as the exogenous, are also divided into two classes, those which are without glumes or husks surrounding the flower,^g and those which have them.^h Lilies, tulips, jonquils, and hyacinths are examples of the former, and the grasses and various kinds of grain of the latter. In this latter division are comprised about one twelfth part of the described species of flowering plants, and yet these species embrace at least nine tenths of the number of individuals composing the vegetable world; nor is their number surprising when we consider that the grasses are the chief source of that verdure which covers the earth of northern countries with a gay carpet of green during the months of summer.

4. The flowerless plants, which are remarkable for the extreme simplicity of their structure, having no wood, properly so called, but consisting of mere masses of cells, are divided into the *acrogens*,ⁱ or summit-growers, and the *thallogens*,^j which grow into a mere flat or round expansion. In the former are included all such plants as ferns, scouring rushes, liverworts, and mosses; and in the latter the lichens,^k fungus plants, sea-weeds, and mushrooms.

5. Thus, in the three great divisions of the vegetable world—the exogenous, the endogenous, and the cryptogamous^l or flowerless plants—there are six natural classes. These are divided into about 170 orders, which are composed of genera or families, as in the artificial system. The orders are found-

^b Called by botanists *Cryptogamous* plants.

^c EX-ŌŪ'-EN-ŌUS; ^d EN-DŌŪ'-EN-ŌUS, see Fourth Reader, p. 176.

^e Called *Gymnosperms*.

^f Called *Angiosperms*.

^g Called *Annisperms*.

^h Called *Glumaceous*.

ed on the most manifest characteristics of the plant, below the distinctions of classes. Thus compound flowers make an order called the *composite*;ⁱ the numerous pod-bearing plants are arranged in the *leguminous*^j order; and flowers in the form of a cross indicate the order cross-shaped, or *cruciferous*.^k

6. It requires much more knowledge of botany to examine a plant and find a description of it by the natural than by the artificial method; but as it is applicable in many instances when the latter is inadequate, the reader who designs to pursue the delightful study of plants further than the design of this series of Readers permits, should make himself familiar with both systems, as explained in the excellent text-books of Gray, Wood, Darby, and Mrs. Lincoln.

7. We have spoken of a *natural classification*; but that which has thus far been developed by the labors of botanists has still much of the artificial. Finite knowledge can not grasp the infinite. "There is a systematic arrangement in nature which science did not *invent*, but gradually *discovered*. The terms in which this arrangement is expressed are the translation, into human language, of the thoughts of the Creator." This is the comprehensive view of scientific classification held by the most scientific men of the day. The Author of nature is the author of the natural system of classification.

8. Most exalted, then, is the study of the laws and arrangement of the vegetable world. Why seek trifling sources of enjoyment,

When at hand,
 Along these blushing borders bright with dew,
 And in yon mingled wilderness of flowers,
 Fair-handed Spring unbosoms every grace?
 She sends the snow-drop, and the crocus first;
 Then daisy, primrose, violet darkly blue,
 And polyanthus of unnumber'd dyes;
 Then yellow wall-flower, stain'd with iron brown;
 And lavish stock, that scents the garden round;
 From the soft wing of vernal⁵ breezes sheds
 Anemonies;⁶ auriculas,⁷ enrich'd
 With shining meal o'er all their velvet leaves;
 And full ranunculus,⁸ of glowing red.

9. Then comes the tulip-race, where beauty plays
 Her idle freaks: from family diffused
 To family, as flies the father-dust,⁹
 The varied colors run; and while they *break*
 On the charm'd eye, th' exulting florist marks,
 With secret pride, the wonders of his hand.
 No gradual bloom is wanting; from the bud,
 First-born of spring, to summer's musky tribes;
 Nor hyacinths of purest virgin white,
 Low-bent, and blushing inward; nor jonquils
 Of potent fragrance; nor Narcissus¹⁰ fair,

ⁱ The *Compos'itæ*, or sunflower tribe.

^j *Legumino'sæ*, having papilionaceous, or butterfly-shaped flowers.

^k *Cruci'feræ*, or cross-bearing; also called *crucifera*.

As o'er the fabled fountain hanging still ;
 Nor broad carnations, nor gay-spotted pinks ;
 Nor, shower'd from every bush, the damask rose ;
 Infinite numbers, delicacies, smells,
 With hues on hues expression can not paint—
 The breath of Nature, and her endless bloom.

10.

Hail, Source of Being! Universal Soul
 Of heaven and earth! Essential Presence, hail!
 To Thee I bend the knee; to Thee my thoughts,
 Continual, climb; who, with a master-hand,
 Hast the great whole into perfection touch'd.
 By Thee the various vegetative tribes,
 Wrapped in a filmy net, and clad with leaves,
 Draw the live ether, and imbibe the dew;
 By Thee disposed into congenial soils,
 Stands each attractive plant, and sucks, and swells
 The juicy tide; a twining mass of tubes.
 At Thy command the vernal sun awakes
 The torpid sap, detruded¹¹ to the root
 By win'try winds; that now in fluent dance,
 And lively fermentation, mounting, spreads
 All this innumerable-colored scene of things.—THOMSON.

¹ AC'-RO-GÈNS, see p. 196.

² THAL'-LO-GÈNS, see p. 202.

³ LI'-CHENS, see p. 202.

⁴ CRYP-TÓG'-A-MOUS, see p. 196.

⁵ VÈR'-NAL, pertaining to the spring.

⁶ A-NÈM'-O-NE, the wind-flower.

⁷ AU-BË'-Û-LA, a beautiful species of prim-rose.

⁸ RA-NUN'-CU-LUS, the crowfoot.

⁹ "FATHER-DUST," the pollen of plants. See Fourth Reader, p. 223.

¹⁰ NAR-CIS'-SUS. According to Grecian fable, *Narcissus* was a beautiful youth, who, seeing his image reflected in a fountain, and becoming enamored of it, pined away till he was changed into the flower which bears his name.

¹¹ DE-TRÛ'-DED, driven or thrust down.

MAY FLOWERS.

"Blessed be God for flowers;
 For the bright, gentle, holy thoughts that breathe
 From out their odorous beauty like a wreath
 Of sunshine on life's hours."

The welcome flowers are blossoming
 In joyous troops revealed;
 They lift their dewy buds and bells
 In garden, mead, and field.
 They lurk in every sunless path
 Where forest children tread,
 They dot like stars the sacred turf
 Which lies above the dead.

They sport with every playful wind
 That stirs the blooming trees,
 And laugh on every fragrant bush
 All full of toiling bees;
 From the green marge of lake and stream,
 Fresh vale and mountain sod,
 They look in gentle glory forth,
 The pure sweet flowers of God.—LYONS.

I'll teach thee miracles! Walk on this heath,
 And say to the neglected flower, "Look up,
 And be thou beautiful!" if thou hast faith

It will obey thy word.—BARRINGTON.

FIRST DIVISION OF THE VEGETABLE KINGDOM. EXOGENS.

[The four most important physiological peculiarities of this great natural division are, 1st. The plants are *Exogenous*, or outward growers. (See Fourth Reader, p. 176.) 2d. The leaves are *net-veined*. 3d. The flowers are mostly *quinary* or *quaternary*—that is, they have five or four sepals, petals, and stamens, or some power of those numbers—rarely ternary. 4th. The embryo has *two* cotyledons; that is, the plants are *dicotyledonous*. Other peculiarities will be noticed under the different *families* which compose the division.]

LESSON IV.—THE ROSE FAMILY.

[EXOGENOUS¹ or DICOTYLEDONOUS;² Angiosperms;³ *Polypetalous*.⁴]



1. *Ro'sa gal'lica*, French rose, xi. 12, pk., 3 f., Jn.—Jl., France. 2. *Ro'sa damasce'na*, Damask rose, xi. 12, r., 3 f., Jn.—Jl., Levant. 3. *Ro'sa musco'sa*, Moss rose, xi. 12, r., Jn.—Jl., S. Europe. 4. *Ro'sa cinnamo'nea*, Cinnamon rose, xi. 12, pk., 6 f., My., Europe. 5. *Fraga'ria grandiflo'ra*, Wild-pine strawberry, xi. 12, w., 1 f., Ap.—My., S. Am. 6. *Ru'bus occidenta'lis*, Am. raspberry, xi. 12, w., 5 f., My.—Jn., N. Am. 7. *Spiræ'a salicifo'lia*, Willow-leaved spiræa, or Queen of the Meadow, xi. 5, w., 3 f., Jn.—Au., N. Am. 8. *Spiræ'a ulmifo'lia*, Elm-leaved spiræa, xi. 5, w., 3 f., Jn.—Jl., S. Europe. 9. *Spiræ'a tomento'sa*, Hard-hack spiræa, xi. 5, r., 3 f., Au.—S., N. Am.

For explanation of the characters used in connection with the botanical descriptions, see close of the Table of Contents.

1. How much of memory dwells amid thy bloom',
Rose! ever wearing beauty for thy dower!
The Bridal day—the Festival—the Tomb—
Thou hast thy part in each, thou stateliest flower!
2. Therefore with thy soft breath come floating by
A thousand images of Love and Grief,
Dreams, fill'd with tokens of mortality',
Deep thoughts of all things beautiful and brief.

3. Not such thy spells o'er those that hail'd thee first
In the clear light of *Eden's* golden day';
There thy rich leaves to crimson glory burst,
Link'd with no dim remembrance of decay.
4. Rose! for the banquet gathered, and the bier;
Rose! colored now by human hope or pain;
Surely where death is not—nor change, nor fear,
Yet may we meet thee, Joy's own Flower, again!—MRS. HEMANS.

5. At the head of the exogenous, or outward growing plants, having covered seeds, and many petals or flower leaves, may be placed the Rose family, which is conspicuous for the beauty of some of its members, and the utility of others. It not only includes the rose proper, but the beautiful spiræas of our lawns and gardens; the hawthorn, which is employed in hedges; the strawberry, the raspberry, and the blackberry; and also such fruits as the apple, pear, quince, almond, peach, plum, and cherry.

6. The leaves of all plants in the rose family are alternate,⁵ and the flowers, in their wild state, are regular, with five petals, as may still be seen in the wild brier, which is one of our wild roses. The hundred-leaf roses, cabbage roses, and all roses with more than five petals, have probably had their stamens changed to petals by cultivation. The artificial or cultivated roses—as likewise all plants which have been changed in the same manner—have to be propagated from cuttings, roots, or buds, as they do not produce perfect seeds.

7. In some parts of India roses are extensively cultivated for the manufacture of rose-water, and the ottar or oil of roses, the former being used chiefly by the natives at their festivals and weddings, when it is distributed largely to the guests as they arrive, and sprinkled with profusion in the apartments. On the banks of the Ganges roses are cultivated in fields of hundreds of acres; and it is said their delightful odor can be scented at a distance of seven miles. The pure ottar of roses, so delicious for its fragrance, is not unfrequently sold for twenty or thirty dollars an ounce.

8. "The rose looks fair', but fairer we it deem
For that sweet odor which doth in it live.
The canker⁶ blooms have full as deep a dye
As the perfumed tincture of the roses',
Hang on such thorns', and play as wantonly
When summer's breath their masked buds discloses.
But, for their virtue', they have naught but show';
They live unmoved', and unrespected fade'—
Die to themselves': sweet roses' do not so';
Of their sweet deaths' are sweetest odors made."

9. Persia has been styled, pre-eminently, the "Land of Roses;" for not only are the gardens, even of the common people, full of these flowers, but, in the flowering season, their

rooms are constantly ornamented with them, and mattresses are made of their leaves for men of rank to recline upon. A festival, also, is held, called the Feast of Roses, which lasts the whole time they are in blossom.

10. A happier smile illumines each brow,
 With quicker spread each heart uncloses,
 And all is ecstasy—for now
 The valley holds its Feast of Roses;
 That joyous time, when pleasures pour
 Profusely round, and in their shower
 Hearts open, like the season's rose,
 The floweret of a hundred leaves,
 Expanding when the dew-fall flows,
 And every leaf its balm receives.—MOORE.

11. "Poetry is lavish of roses. It heaps them into beds, weaves them into crowns and garlands, twines them into arbors, forges them into chains, adorns with them the goblet used in the festivals of Bacchus, plants them in the bosom of beauty—nay, not only delights to bring in the rose itself upon every occasion, but seizes each particular beauty it possesses as an object of comparison with the loveliest works of nature." "As soft as a rose-leaf," as "sweet as a rose," "rosy clouds," "rosy cheeks," "rosy lips," "rosy blushes," "rosy dawns," etc., are expressions so familiar that they have almost become the language of daily life.

12. The wild rose, one species of which is the wild brier, or eglantine, has been made the emblem of "Nature's sweet simplicity" in all ages. It forms one of the principal flowers in the rustic's bouquet.⁷ It is not loved for its fair, delicate blossoms only; but its fragrant leaves, which perfume the breeze of dewy morn, and the soft breath of eve, entitle it to its frequent association with the woodbine or honeysuckle.

- "The wild rose scents the summer air,
 And woodbines weave in bowers,
 To glad the swain sojourning there,
 And maidens gathering flowers."

13. The standards of the houses of York and Lancaster had for emblems the wild rose; the white rose being used to distinguish the partisans of the former, and the red those of the latter.

- "Thou once wast doomed,
 Where civil discord brayed the field,
 To grace the banner and the shield."

14. It is said that the angels possess a more beautiful kind of rose than those we have on earth; and the poet Cowley, in one of his poems, represents David as seeing, in a vision, a number of angels pass by, with gilded baskets in their hands, from which they scattered flowers:

Some¹, as they went¹, the blue-eyed violets strew¹;
 Some, spotless lilies in loose order threw¹,
 Some did the way with full-blown roses spread¹,
 Their smell divine¹, and color strangely red¹:
 Not such as our dull gardens proudly wear,
 Whom weathers taint, and winds' rude kisses tear.
 Such, I believe, was the first rose's hue,
 Which, at God's word, in beauteous Eden grew;
 Queen of the flowers that made that garden gay,
 The morning blushes of the spring's new day.—COWLEY.

15. The origin of the *red* color of the rose has been fancifully accounted for in various ways. By the Greeks, the rose was consecrated to Venus, the goddess of Beauty; and ancient fable attributes its red color to a drop of blood from the thorn-pierced foot of the goddess,

"Which, o'er the *white* rose being shed,
 Made it forever after *red*."

Its beautiful tint is poetically traced to another source by a modern poet:

As erst in Eden's blissful bowers,
 Young Eve surveyed her countless flowers¹,
 An opening *rose* of purest *white*
 She mark'd with eye that beam'd delight¹;
 Its leaves¹ she kissed¹, and straight it drew
 From beauty's lip the vermeil² hue.—J. CAREY.

16. Perhaps no one of the roses is more prized for its beauty than the elegant moss rose. The flowers are deeply colored, and the rich mossiness which surrounds them gives them a luxuriant appearance not easily described. The origin of this mossy vest has been thus explained by a German writer.



Moss Rose.

The angel of the flowers one day
 Beneath a rose-tree sleeping lay—
 That spirit, to whose charge is given
 To bathe young buds in dew from heaven.
 Awakening from his slight repose,
 The angel whispered to the rose,
 "O fondest object of my care,
 Still fairest found where all is fair,
 For the sweet shade thou hast given me,
 Ask what thou wilt, 'tis granted thee."
 Then said the rose, with deepened glow,
 "On me another grace bestow."
 The angel paused in silent thought—
 What grace was there the flower had not?
 'Twas but a moment—o'er the rose
 A veil of moss the angel throws—
 And, robed in Nature's simplest weed³,
 Could there a flower that rose exceed⁴?

¹ EX-ÔÙ'-E-NOUS, outward growers. See Fourth Reader, p. 176.
² DI-CO-TYL-E'-DON-ous, having two cotyledons. See Fourth Reader, note, p. 193.
³ AN'-ÔI-O-SPÈRMS, plants which have their seeds covered. [pétale.
⁴ POL-Y-PÈT'-AL-ous, plants having many

⁵ AL-TÈRN'-ATE, rising higher on opposite sides alternately, and following in regular order.
⁶ CANK'-ER, a name given to the dog rose.
⁷ BËU-QUET' (bœ-kâ'), a bunch of flowers.
⁸ VER'-MEIL (for vermillion), a red color.

LESSON V.—OUR COMMON FRUITS.

[EXOGENOUS OR DICOTYLEDONOUS; Angiosperms; *Polypetalous*.]

1. *Amygdalus incana*, Woolly almond, xi. 1, r., 2 f., M.-A., Caucasus. 2. *Amygdalus communis*, Sweet almond, xi. 1, r., 15 f., M.-A., Barbary. 3. *Prunus cerasus*, Common cherry, xi. 1, w., 20 f., A.-My., England. 4. *Prunus Armeniaca*, Common apricot, xi. 1, w., 15 f., F.-M., Levant. 5. *Crataegus nigra*, Black hawthorn, xi. 5, w., 20 f., A.-My., Hungary. 6. *Crataegus punctata*, Common thorn-tree, xi. 5, w., 15 f., My., N. Am. 7. *Crataegus pyrifolia*, Pearl-leaved thorn, xi. 3, w., 15 f., Jn., N. Am. 8. *Cydonia vulgaris*, Common quince, xi. 5, w., 12 f., My.-Jn., Austria.

1. ALL the most important fruits of the temperate regions of the world, such as the strawberry, raspberry, blackberry', and the apple, pear, quince, cherry, plum, apricot, peach, nectarine, and almond', have been classed by botanists in the rose family'; for all of them, in their natural or wild state, have similar characteristics by which they may be distinguished. They are not only exogenous', have covered seeds', and are polypetalous', but their leaves are arranged in alternate order around the stem, and never opposite'; their flowers are showy', have five petals', and are inserted on the calyx'. By these, and a few other more minute characteristics, these numerous plants are arranged in one large family.

2. Of the well-known apple, the most popular of all fruits, no description need be given; but it is well to remember, as an evidence of what cultivation has done, that its many hundred kinds are believed to be mere varieties of one original species, known as the common crab-apple. The apple was known to the ancient Greeks; the Romans had twenty-

two varieties of it; and poets, in all ages, have sung its praises.



The fragrant stores, the wide projected heaps
Of apples, which the lusty-handed year,
Innumerable, o'er the blushing orchard shakes;
A various spirit, fresh, delicious, keen,
Dwells in their gelid¹ pores; and, active, points
The piercing cider for the thirsty tongue.

THOMSON.

3. The pear is a fruit-tree next in popularity and value to the apple, and its wood is almost as hard as box, for which it is even substituted by engravers. Its blossom, of which we give a drawing, exhibits the general character of the blossoms of all the rose family.



"The juicy pear
Lies in soft profusion scattered round.
A various sweetness swells the gentle race,
By Nature's all-refining hand prepared,
Of tempered sun and water, earth and air,
In ever-changing composition mixed."

4. The quince, plum, and apricot we must pass cursorily by, merely remarking of the apricot that it is a fruit intermediate in character between the plum and the peach. The peach and nectarine were considered by the Greeks as merely different varieties of the almond-tree, and as having sprung from it by cultivation. The fruit of the peach has a downy covering, while that of the nectarine is smooth, and both have been known to grow on the same tree, and even on the same branch. The leaves and blossoms of these trees can scarcely be distinguished apart. The blossoms of all of them appear early in spring, before the leaves; and hence those of the almond especially, which are noted for their profusion and beauty, have been made the emblem of hope—so early do they hold out the promise of abundance. Thus Moore says:

"The hope, in dreams of a happier hour,
That alights on misery's brow',
Springs forth like the silvery almond flower,
That blooms on a leafless bough'."

5. Nor is the emblem without its peculiar appropriateness; for so far back as we can trace the history of this tree, its early and fragrant blossoms, appearing before the leaves, were regarded as the promise of a fruitful season. Virgil gave expression to the popular belief in the following lines:

"Mark well the flowering *almond* in the wood';
If odorous blooms the bearing branches load',
The glebe² will answer to the sylvan³ reign';
Great heats⁴ will follow', and large crops of grain';

But, if a wood of *leaves* o'ershade the tree',
 Such, and so barren, will the harvest be';
 In vain the hind⁴ shall vex the threshing-floor',
 For empty straw and chaff shall be thy store."

6. The following tribute from an English poet to the almond blossom is beautiful and appropriate:

Blossom of the almond trees,
 April's gift to April's bees,
 Birthday ornament of spring,
 Flora's fairest daughterling;
 Coming when no flow'rets dare
 Trust the cruel outer air;
 When the royal kingcup bold
 Dares not don his coat of gold;
 And the sturdy blackthorn spray
 Keeps his silver for the May;
 Coming when no flow'rets would,
 Save thy lowly sisterhood,
 Early violets, blue and white,
 Dying for their love of light.

7.

Almond blossom, sent to teach us
 That the spring-days soon will reach us,
 Lest, with longing over-tried,
 We die as the violets died—
 Blossom, clouding all the tree
 With thy crimson broinery,
 Long before a leaf of green
 On the bravest bough is seen;
 Ah! when winter winds are swinging
 All thy red bells into ringing,
 With a bee in every bell,
 Almond bloom', we greet thee well'.—EDWIN ARNOLD.

8. The mountain ash, a small but beautiful and popular tree, also belonging to the pear and apple family, and found wild in mountain woods in our Northern and Middle States, is often cultivated for its ornamental clusters of scarlet berries.

The mountain ash,
 Deck'd with autumnal berries that outshine
 Springs richest blossoms, yields a splendid show
 Amid the leafy woods; and ye have seen,
 By a brook side or solitary tarn,⁵
 How she her station doth adorn; the pool
 Glows at her feet, and all the gloomy rocks
 Are brighten'd round her!—WORDSWORTH.

9. But while the Rose family comprehends all the most important of the fruits of the temperate regions, and is distinguished above all others for its floral charms, its medicinal properties are quite noted also. Thus the well-known Prussic acid, which, although a powerful poison, is also the basis of laurel water, exists in abundance in the leaves and kernels of the plums, cherries, and almonds; and many of the plants of this family yield a gum which is nearly allied to gum Arabic.

¹ GĒL'-ID, cold; very cold.

² GLEBE, the soil; the turf.

³ SYL'-VAN, pertaining to the forest.

⁴ HIND, the servant or domestic of a husbandman or farmer; a rustic.

⁵ TARN, a mountain lake.

LES. VI.—CAMĒLLIA, MALLOW, AND CITRON FAMILIES.

[EXOGENOUS OR DICOTYLEDONOUS; Angiosperms; *Polypetalous*.]

1. *Camēllia japonica*, Japan rose, xv. 12 (a tree in Japan), w. and or., My.—Jl., Japan. 2. *Gossypium herba'ceum*, Common cotton, xv. 12, y., 4 f., Jl., E. Indies. 3. *Gossypium Barbaden'se*, Barbadoes cotton, xv. 12, y., 5 f., S., W. Indies. 4. *Althēa ro'sea*, Common hollyhock, xv. 12, r. and w., 8 f., Jl.—S., China. 5. *Mal'va moscha'ta*, Musk-mallow, xv. 12, pk., 2 f., Jl.—Au., Britain. 6. *Hibiscus milita'ris*, Louisiana hibiscus, xv. 12, pu., 3 f., Au.—S., Louisiana. 7. *Citrus vulga'ris*, Seville orange, xii. 1, w., 15 f., My.—Jl., W. Asia. 8. *Citrus limo'num*, Lemon, xii. 1, w., 15 f., My.—Jl., W. Asia. 9. *Citrus limet'ta*, Lime, xii. 1, w., 8 f., My.—Jl., W. Asia.

1. THE large, beautiful, and rose-shaped flower called *Japonica*, the *loblolly bay* of Southern swamps, and the *tea-plant* of China belong to the Camēllia family.

"The chaste camellia's pure and spotless bloom,
That boasts no fragrance, and conceals no thorn,"

was brought from Japan about the year 1739, and is justly esteemed one of the choicest ornaments of the green-house. A great many varieties, ranging from the purest white through delicate blush, and striped, to deep red, have been produced by cultivation. The white camellia is often addressed by the poets, as in the following sonnet, as an emblem of perfected loveliness.

2. Say, what impels' me, pure and spotless flower',
To view thee with a secret sympathy'?
Is there some living spirit shrined in thee'?

That, as thou bloom'st within thy humble bower,
 Endows thee with some strange mysterious power,
 Waking high thoughts? As there perchance might be
 Some angel-form of truth and purity,
 Whose hallowed presence shared my lonely hour?
 Yes, lovely flower, 'tis not thy virgin glow,
 Thy petals whiter than descending snow,
 Nor all the charms thy velvet folds display;*
 'Tis the soft image of some beaming mind,
 By grace adorn'd, by elegance refined,
 That o'er my heart thus holds its silent sway.—W. ROSCOE.

3. The famous tea-plant of China, a drawing of a stalk of which is here given, of about one quarter the natural size, is regarded by many botanists as merely a species of the *camellia*, which it much resembles in the form of its leaves and blossoms. Some dried leaves of tea were first brought to Europe in the seventeenth century by a Russian nobleman; and now, out of China, the annual consumption of this one plant, as a beverage, is estimated at a hundred millions of pounds.



Green Tea (*Thea viridis*).

4. For this amount the Chinese people receive nearly thirty millions of dollars; and yet it is believed that they themselves consume twenty times more than the entire amount exported from their country! The different kinds and quality of tea depend chiefly upon the time of plucking the leaves, the mode in which they are prepared for use, and the soil on which they grow, rather than upon any specific differences in the plants themselves.

5. In China and Japan tea is sold in shops and at the street corners, and borne about in kettles by itinerant merchants, who sell small cups—without sugar or milk, as it is universally taken in the East—at a trifling price. A tea-drinking in a rich man's house is, however, a very ceremonious affair. No tea-pots are used, but a portion of leaves is put into each cup, and boiling water poured on them. It would be highly indecorous to spill a drop out of the cups during the bowings which precede the drinking; and to prevent this they are but half-filled. The guests drink at many sips, and it is a point of politeness for all to empty their cups exactly at the same time, that they may put them down at once.

* The downward inflection is appropriate here, because it is, really, the conclusion of the sentiment, the remaining three lines being merely a repetition of the sentiment previously expressed. If we had given only the last six lines, beginning with "Lovely flower," the rising inflection would have been required at "display."

6. Tea is served very hot; but it is a flagrant breach of etiquette in any one to notice this unpleasant fact. Should the weather be very warm, when the cups are emptied the master of the house says, "I invite you to take up your fans." But should any unlucky guest have forgotten his fan, the rest of the company do not permit themselves the liberty of using theirs, for fear of hurting his feelings. Finally, after innumerable tedious acts of politeness, in which each individual aims to produce the impression that, in his own opinion, his insignificant person is by no means worthy the exalted honor of drinking with the illustrious company among whom he is infinitely surprised to be received, the signal for leave-taking is given by the highest in rank rising and saying to the host, "I have been troublesome to you a very long time"—which is probably the only true word spoken during the entertainment.

7. We might speak of American tea-parties also, but they are too well-known and appreciated to need description here; for even the poetic muse has been evoked, on more occasions than one, to give them notoriety.

"How they sit and chitter chatter',
O'er a cup of scalding water',
Of this one's dress or carriage',
Of that one's death or marriage'."

8. In the *Mallow* family, which contains a great variety of some of the finest flowers in nature, are found the various species of the altheas or hollyhocks, and the hibiscus, together with that famous plant, "King Cotton," avowedly the most valuable of all the vegetable products which man converts into materials for clothing. The common cotton plant grows from three to five feet in height, with five-lobed, blue-veined, dark green leaves. The flower is of a pale yellow, changing to a pink color, purple spotted at the bottom, with five petals. On the falling of the flower a kind of pod or boll is developed, which, in process of ripening, bursts and discloses the snow-white cotton, which is the hairy covering of the seeds.



Cotton Plant.—1. The ripened boll. 2. Flower in the morning. 3. Flower at evening.

9. The *citron* family embraces a number of species of handsome evergreen shrubs or small trees, mostly natives of the East Indies, and cultivated only in warm regions. They have odoriferous flowers, and bear some of the most brilliant, fra-

grant, and delicious fruits, among which may be enumerated the orange, shaddock, citron, lemon, and lime. As with apples, many varieties of each have been produced by cultivation. The golden apples of the heathens, and the forbidden fruit of the Jews, are supposed to belong to this family. The orange blossom, distinguished no less for its beauty than its delicious fragrance, has very appropriately been made the emblem of purity and loveliness. The land where the citron and orange grow is proverbially the land of balmy fragrance, of gentle breezes, and azure skies.

Know'st thou the land, where groves of citron flower' ?
 And golden orange, darkling leaves embower' ?
 Where gentle breezes fan the azure skies,
 The myrtle still, and high the laurel rise' ?
 Know'st thou it well, that land, beloved friend' ?
 Thither with thee, oh, thither would I wend.—GOETHE.

LESSON VII.—CHORUS OF FLOWERS.

1. We are the sweet flowers',
 Born of sunny showers';
 (Think, whene'er you see us, what our beauty saith);
 Utterance, mute and bright,
 Of some unknown delight,
 We fill the air with pleasure' by our simple breath':
 All who see us' love' us—
 We befit all places';
 Unto sorrow we give smiles'—and, unto graces, races'.
2. Think of all our treasures',
 Matchless works and pleasures',
 Every one a marvel, more than thought can say';
 Then think in what bright showers
 We thicken fields and bowers',
 And with what heaps of sweetness half stifle wanton May';
 Think of the mossy forests
 By the bee-birds haunted',
 And all those Amazonian plains, lone lying as enchanted.
3. Trees *themselves* are ours';
 Fruits are born of flowers';
 Beech', and roughest nut', were blossoms' in the spring';
 The lusty bee knows well
 The news, and comes pell-mell,
 And dances in the gloomy thicks with darksome antheing:
 Beneath the very burden
 Of planet-pressing ocean
 We wash our smiling cheeks in peace—a thought for meek devotion.
4. Who shall say that flowers
 Dress not heaven's own bowers' ?
 Who its love, without us, can fancy—or sweet floor' ?

Who shall even dare
 To say we sprang not there—
 And came not down, that Love might bring one piece of heaven the
 Oh! pray believe that angels [more?]
 From those blue dominions
 Brought us in their white laps down, 'twixt their golden pinions.

LEIGH HUNT.

LESSON VIII.—THE CACTUS FAMILY.

[EXOGENOUS OR DICOTYLEDONOUS; Angiosperms; Polypetalous]



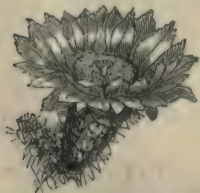
1. *Cactus hexagonus*, Four-angled cactus, xi. 1, w., 35 f., Jl.-Au., S. Am. 2. *C. speciosissimus*, Beautiful cactus, xi. 1, cr., 3 f., Jl., S. Am. 3. *C. flagelliformis*, Creeping or Snake cactus, xi. 1, pk., 6 f., M.-Jn., Peru. 4. *C. opuntia*, Prickly-pear cactus, xi. 1, y., 2 f., Jl.-Au., Mexico. 5. *C. curassavicus*, Pin-pillow cactus, xi. 1, y., 6 f., Jn.-Jl., S. Am. 6. *C. pereskia*, Gooseberry cactus, xi. 1, w., 5 f., O.-N., W. Indies. 7. *C. phyllanthoides*, Winged cactus, xi. 1, pk., 2 f., Jn., W. Indies. 8. *Echinocactus mamillarioides*, Melon cactus, xi. 1, y. and r., 6 in., Jl.-Au., Chili.

1. Who hung thy beauty on such rugged stalk,
 Thou glorious flower?

Who poured the richest hues,
 In varying radiance, o'er thy ample brow,
 And, like a mesh, those tissue'd stamens laid
 Upon thy crimson lip?

Lone, o'er thy leafless stem,
 Thou bidd'st the queenly rose, with all her buds,
 Do homage, and the green-house peerage bow
 Their rainbow coronets."¹—MRS. SIGOURNEY.

2. Thus beautifully writes an American poetess of a beautiful flower of the rough cactus family. And this family is exclusively American, not one of its eight hundred



Mammillaria cespitosa,
 a Cactus flower of the Upper Missouri.

red species having ever been found, as native, in any other part of the world. The name by which the kinds of cactus common in the Northern and Middle States are known, is *prickly pear*. The absence of leaves in most of the species, and the presence of very showy flowers, render this family remarkable. The plants consist chiefly of a fleshy stem, sometimes globular or egg-shaped, sometimes cylindrical, triangular, and even flat, but always armed with prickles.

3. The cactus is found abundantly in Mexico, and is painted on the flag of the Mexicans, and stamped on their money; Of its many species, the *night-blooming cereus*² is perhaps the most remarkable, not so much on account of its large white flower, although that is sometimes nearly a foot in diameter, as for the season of its unfolding its beauties, the short time which it takes to expand, and the rapidity with which it decays. It begins to open late in the evening, flourishes for an hour or two, then begins to droop, and before morning is completely dead.

4. "Now departs day's garish³ light—
Beauteous flower', lift thy head' !
Rise upon the brow of night' !
Haste, thy transient lustre shed' !
5. Night has dropp'd her dusky veil—
All vain thoughts be distant far,
While, with silent awe, we hail
Flora's radiant evening star.
6. See to life her beauties start' ;
Hail! thou glorious, matchless flower' !
Much thou sayest to the heart
In this solemn, fleeting hour.
7. Ere we have our homage paid',
Thou wilt bow thy head and die' ;
Thus our sweetest pleasures fade',
Thus our brightest blessings fly'.
8. Sorrow's rugged stem, like thine',
Bears a flower thus purely bright' ;
Thus, when sunny hours decline,
Friendship sheds her cheering light."

9. Other species of the cactus, more delicate in structure than the famous *cereus*² already described, a few of them leafy, some of them creeping plants, and most of them remarkable for their beauty and fragrance, also bloom in the night season; and it is one of these which has been made the medium, by a gifted writer, of conveying the following beautiful moral:

UNPRETENDING WORTH.

10. Come, look at this plant, with its narrow, pale leaves,
And its tall, thin, delicate stem,
Thinly studded with flowers—yes, with flowers—there they are;
Don't you see, at each joint there's a little brown star' ?
But, in truth, there's no beauty in them'.

11. So you ask why I keep it—the little mean thing' ?
 Why I stick it up here, just in sight' ?
 'Tis a fancy' of mine. A strange fancy, you say.
 No accounting for tastes—in this instance you may,
 For the flower. But I'll tell you to-night.
12. Some six hours hence, when the lady moon
 Looks down on that bastioned wall,
 When the twinkling stars glance silently
 On the rippling surface of the sea,
 And heavy the night dews fall—
13. Then meet me again in this casement niche,
 On this spot—nay, do not say no,
 Nor question me wherefore ; perhaps with me
 To look out on the night, and the bright broad sea,
 And to hear its majestic flow.
- * * * * *
14. Well, we're met here again, and the moonlight sleeps
 On the sea and the bastioned wall ;
 And the flowers there below—how the night wind brings
 Their delicious breath on its dewy wings ;
 But there's one, say you, sweeter than all.
15. What is it' ? the myrtle or jessamine' ?*
 Or their sovereign lady, the rose' ?
 Or the heliotrope, or the virgin's bower' ?
 What' ! neither' ? Oh, no, tis some other flower,
 Far sweeter than any of those.
16. Far sweeter' ? And where think you groweth the plant
 That exhalet that perfume rare' ?
 Look about, up and down, but take care, or you'll break
 With your elbow that poor little thing that's so weak.
 Why, 'tis *that* smells so sweet, I declare' !
17. Ah ha ! is it *that*' ? Have you found out now
 Why I cherish that odd little fright' ?
 All is not gold that glitters, you know,
 And it is not all worth makes the greatest show,
 In the glare of the strongest light'.
18. There are *human* flowers, full many, I trow,⁴
 As unlovely as that by your side,
 That a common observer passeth by
 With a scornful lip and a careless eye,
 In the heyday of pleasure and pride.
19. But move one of these to some quiet spot
 From the midday sun's broad glare,
 Where domestic peace broods with dove-like wing,
 And try if the homely, despised thing
 May not yield sweet fragrance there.
20. Or wait till the days of trial come,
 The dark days of trouble and woe,
 When *they* shrink and shut up, late so bright in the sun ;
 Then turn to the little despised one,
 And see if 'twill serve you so.
21. And judge not again, at a single glance,
 Nor pass sentence hastily.
 There are many good things in this world of ours,
 Many sweet things and rare, weeds that prove precious flowers,
 Little dreamt of by you or by me.—MRS. SOUTHEY.

1 CÖR'-O-NET, a little crown.

2 CË'-REÛS (*së'-ri-ae*), in two syllables.

3 GÄR'-ISH, gaudy ; splendid.

4 TRÖW, suppose or think.

* Equivalent to, "Do you ask, 'What is it' ? the myrtle or jessamine' ?" etc., similar to the questions in the eleventh verse ; and therefore they take the rising inflection.

LESSON IX.—LEGUMINOUS AND UMBELLIFEROUS PLANTS.

[EXOGENOUS OR DICOTYLEDONOUS; Angiosperms; *Polypetalous*.]

Umbelliferous Family.

Leguminous Family.

1. *Lupinus perennis*, Wild lupine, xvi. 10, b., 18 in., My.-Jl., N. Am. 2. *Erythrina herbaacea*, Herbaceous coral-tree, xvi. 10, s., 3 f., Jn.-S., Carolina. 3. *Robinia pseudoacacia*, Locust-tree, xvi. 10, pu., 40 f., My.-Jn., N. Am. 4. *Mimosa sensitiva*, Sensitive plant, xv. 10, pk., 18 in., A.-S., Brazil. 5. *Haematoxylon Campechianum*, Logwood, x. 1, y., 20 f., J.-Jl., S. Am. 6. *Indigofera stricta*, Upright indigo, xvi. 10, pu., 3 f., Jl.-Au., C. Good Hope. 7. *Daucus carota*, Wild carrot (also cultivated), v. 2, w., 3 f., Jn.-Jl., Europe. 8. *Sium latifolium*, Water parsnip, v. 2, w., 3 f., Jl.-Au., N. Am. 9. *Conium maculatum*, Poison hemlock, v. 2, w., 4 f., Jn.-Jl., Europe. 10. *Apium graveolens*, Garden celery, v. 2, w., 4 f., Jn.-Au., Europe.



1. Legum. of pea, open. 2 and 3. Papilionaceous corollas.

1. THE leguminous¹ or pod-bearing plants comprise a large family, highly useful to mankind, and some of whose species are familiar to all. They are characterized either by a papilionaceous² corolla or a leguminous fruit. The pea, the bean, locust, clover, and lupine are familiar examples in northern regions; and the acacias, mimosas, logwood, rosewood, sandal-wood, coral-trees, and indigo plants, in tropical countries. Many of the valuable gums and balsams^a of commerce, medicines,^b

and coloring materials* are obtained from this numerous family.

2. As objects of ornament, many of these plants are possessed of unrivaled beauty, and are favorites in our green-houses ; but it is in tropical countries that they appear in their greatest splendor. There, flowers of the corol-tree, of the deepest crimson, fill the forests, and climbing plants of every hue hang in festoons from branch to branch ; the acacias, with their trembling airy foliage, and often truly golden flowers, cast a charm over even the most sterile regions of the tropics ; while the pastures and meadows of the same latitudes are enameled with the flowers of myriads of hedysarums, and animated by the wonderful motion of the *mimosas*, or sensitive plants.

3. Who has not read Shelley's beautiful little poem, beginning,

"A sensitive plant in a garden grew,
And the young winds fed it with silver dew,
And it spread its fanlike leaves to the light,
And closed them beneath the kisses of night."

The sensitive plants, often cultivated in gardens as objects of curiosity, shrink from the touch, and make a variety of movements under the varying influences of shade and sunlight, like beings endowed with rational life.

Weak with nice sense, the chaste *mimosa* stands,
From each rude touch withdraws her timid hands ;
Oft, as light clouds o'erpas the summer's glade,
Alarm'd she trembles at the morning shade,
And feels, alive through all her tender form,
The whisper'd murmurs of the gathering storm ;
Shuts her sweet eyelids to approaching night,
And hails, with freshen'd charms, the rosy light.—DARWIN.

The cause of the peculiar motions of these plants has been a subject of much investigation, but the question still continues to be asked, without any very satisfactory answer,

Whence does it happen that the plant which well
We name the *sensitive*, should move and feel ?
Whence know her leaves to answer her command,
And with quick horror fly the approaching hand ?—PRIOR.

4. The umbelliferous³ plants, also a large family, mostly natives of temperate regions, and distinguished for their umbel or umbrella-shaped flowers, like those of the carrot, present some very strange contrasts of character. While in their

* Such as gum Arabic, produced by the *acacia Arabica* ; gum lac ; gum Senegal ; gum tragacanth ; gum kino ; balsams of copaiva and Peru ; and a hedysarum which produces *manna*.

^b The senna of commerce ; licorice ; cowitch, which consists of the stinging hairs of the pods of a plant ; etc.

^c Brazil wood ; logwood ; red sandal-wood ; indigo, etc.

native ditches they are often suspicious, and perhaps poisonous weeds, under the influence of cultivation many of them lay aside their venom, and become wholesome food for man. Thus a coarse bitter wild weed becomes by cultivation the sweet and crisp garden celery; the garden parsnip is nearly allied to the poisonous cicuta; and while the seeds of the garden fennel are a pleasant spice, the juice from the roots of another species of the same plant produces the loathsome asafœtida.

5. Only slightly divergent from the umbelliferous plants, and by many botanists included among them, are the *ivy-worts*, at the head of which stands the common ivy:

"The *ungrateful* ivy, seen to grow
Round the tall oak, that six-score years has stood,
And proudly shoot a leaf or two
Above its kind supporter's utmost bough,
And glory there to stand, the loftiest of the wood."

6. But, however ungrateful it may be, the ivy is a valuable ornamental evergreen for covering naked buildings, trees, and ruins, to which it attaches itself by short fibres. The ancients held ivy in great esteem; and Bacchus, the god of wine, is represented as crowned with it to prevent intoxication. The modern associations connected with this plant are very happily set forth in the following song to THE IVY GREEN.

7. Oh! a dainty plant is the ivy green,
That creepeth o'er ruins old!
Of right choice food are his meals, I ween,
In his cell so lone and cold.
The walls must be crumbled, the stones decayed,
To pleasure his dainty whim;
And the mould'ring dust that years have made
Is a merry meal for him.
Creeping where no life is seen,
A rare old plant is the ivy green.

8. Fast he stealeth on, though he wears no wings,
And a stanch old heart has he!
How closely he twineth, how tight he clings
To his friend, the huge oak tree!
And slyly he traileth along the ground,
And his leaves he gently waves,
And he joyously twines and hugs around
The rich mould of dead men's graves.
Creeping where no life is seen,
A rare old plant is the ivy green.

9. Whole ages have fled, and their works decayed,
And nations scattered been;
But the stout old ivy shall never fade
From its hale and hearty green.
The brave old plant in its lonely days
Shall fatten upon the past;
For the stateliest building man can raise
Is the ivy's food at last.
Creeping where no life is seen,
A rare old plant is the ivy green.—CHARLES DICKENS.

¹ LE-GŪ'-MI-NOUS plants are such as have for their seed vessel a *legume* of two halves, such as the pods of peas, beans, etc.
² PA-PIL-I-O-NĀ'-OE-OUS, resembling the butterfly.
³ UM-BEL-LIF'-ER-OUS plants are such as have the mode of inflorescence, or flowering, called an *umbel*, like the carrot.

LES. X.—THE COMPOSITE, OR SUNFLOWER FAMILY.

[EXOGENOUS OR DICOTYLEDONOUS; Angiosperms; *Monopetalous*.]¹

1. *Cni'cus altis'sinus*, Tall thistle, xvii. 1, pu., 6 f., Au.-S., N. Am. 2. *Cni'cus arven'sis*, Canada thistle, xvii. 1, pu., 2 f., Jl., N. Am. 3. *Helian'thus multifo'rus*, Many-flowered sunflower, xvii. 3, y., 6 f., Au.-O., N. Am. 4. *Chrysan'themum Sinen'se*, Chinese chrysanthemum, xvii. 2 (all colors but blue), 3 f., O.-N., China. 5. *Lactu'ca sagitta'ta*, Arrow-leaved Lettuce, xvii. 1, y., 2 f., Jl.-Au., Hungary. 6. *Gnapha'tium sta'chas*, European shrubby everlasting, xvii. 2, y., 2 f., Jn.-O., Europe. 7. *As'ter Chinen'sis*, China-aster, xvii. 2, various colors, 2 f., Jl.-S., China. 8. *Dah'lia frustra'nea*, Wild dahlia, xvii. 2, various colors, 6 f., S.-N., Mexico. 9. *Tage'tes pat'ula*, French marigold, xvii. 2, y., 2 f., Jl.-O., Mexico.

1. The "*Sunflower*" family is the name used by that distinguished American botanist, Professor Gray, as a popular term for the great division of plants having composite or compound flowers. It is the largest family of plants, embracing nearly ten thousand species, or about one tenth of all the species of the vegetable kingdom. They are either herbaceous or shrubby plants in northern regions, but many of them become trees in the tropics; and all of them are easily distinguished by having their single or monopetalous¹ flowers (called *florets*), which are always five-lobed, and have five stamens each, crowded into a head at the top of a flower-stalk, as in the daisy, dandelion, sunflower, and thistle.

2. These composite plants are, without exception, of easy



Cultivated Dahlia.

cultivation; and as most of them flower in autumn, they are the chief ornaments of every autumnal garden. It would require a volume to point out the beauties of the various tribes of aster, sunflower, coreopsis, marigold, daisy, chrysanthemum, and kindred species, not to mention the almost innumerable and brilliant varieties of the dahlia. As to the medicinal qualities of the plants of this family, it is sufficient to state that they consist, almost without exception, of a bitter principle and an oily secretion; and of the former, at least, we have abund-

ant evidence in such species as wormwood, chamomile, dandelion, and tansy.

3. The dandelion was one of the flowers introduced by Linæus into his *floral clock*, or dial of flowers, on account of the regularity of the opening and closing of its petals. It was deemed by him "Flora's best time-piece, seeming of herself to know the opening and the closing of the day," inasmuch as

"With Sol's expanding beam her flowers uncloze,
And rising Hesper² lights them to repose;"

and Moore has very prettily expressed the same idea in the following lines:

"She, enamored of the sun,
At his departure hangs her head and weeps,
And shrouds her sweetness up, and keeps
Sad vigils, like a cloistered nun,
Till his reviving ray appears,
Waking her beauty as he dries her tears."

4. The marigold not only marked one of the hours in the floral clock, but she is said also, like the sunflower itself, to turn on her slender stem toward the sun, and thus follow him in his daily walk.

"When, with a serious musing, I behold
The grateful and obsequious marigold,
How duly, every morning, she displays
Her open breast when Phœbus³ spreads his rays';
How she observes him in his daily walk,
Still bending tow'rd him her small slender stalk';
How, when he down declines, she droops and mourns,
Bedew'd as 'twere with tears, till he returns';
And how she veils her flowers when he is gone,
As if she scorned to be look'd upon
By an inferior eye'; or did contempt
To wait upon a meaner light than him':

5.

When this I meditate, methinks the flowers
Have spirits far more generous than ours,

And give us fair examples to despise
 The servile fawnings and idolatries
 Wherewith we court these earthly things below
 Which merit not the service we bestow':
 But oh, my God! though groveling I appear
 Upon the ground, and have a rooting here
 Which hales me downward, yet in my desire
 To that which is above me I aspire,
 And all my best affections I profess
 To Him that is the Sun of Righteousness."

6. The *daisy*, too, whose English name is derived from a Saxon word meaning *day's eye*, closes its petals at night and in rainy weather.

When, smitten by the morning ray,
 I see thee rise, alert and gay,
 Then, cheerful flower! my spirits play
 With kindred gladness':

And when, at dark, by dews oppress'd,
 Thou sink'st', the image of thy rest
 Hath often eased my pensive breast
 Of careful sadness'.—WORDSWORTH.

7. The daisy has been universally admired as an emblem of modest innocence; but, lowly and modest though it be, it has enough of mystery in its wonderful structure "to confound the atheist's sophistries," and prove the being of a God.



Bel'lis peren'nis,
 English Daisy,
 xvii. 2, w. and r.,
 8 in., M.-A., Britain.

8. Not worlds on worlds in phalanx deep,
 Need we to prove that God is here;
 The *daisy*, fresh from winter's sleep,
 Tells of his hand in lines as clear.
9. For who but he who arched the skies,
 And pours the day-spring's living flood,
 Wondrous alike in all he tries,
 Could rear the daisy's purple bud;
10. Mould its green cup, its wiry stem,
 Its fringed border nicely spin,
 And cut the gold-embossed gem
 That, set in silver, gleams within;
11. And fling it, unrestrained and free,
 O'er hill, and dale, and desert sod,
 That man, where'er he walks, may see
 At every step the stamp of God.—JOHN MASON GOOD.

12. The *thistle*, another of the sunflower tribe, though a prickly and not very graceful weed, has given its name to a Scotch order of knighthood. It might be said *the* Scotch order, as it also bears the name of St. Andrew, the patron saint of Scotland. The golden collar of the order, interlaced with flowers of the thistle, and bearing the motto, in Latin, "*None shall annoy me with impunity*," has also been adopted as the national badge. Tradition gives the following account of its origin:

13. "At the time of the invasion of Scotland by the Danes,

it was deemed unwarlike to attack an enemy in the night; but on one occasion the invaders resolved to avail themselves of this stratagem; and, in order to prevent their tramp from being heard, they marched barefooted. They had thus neared the Scottish force unobserved, when a Dane unfortunately stepped with his naked foot upon a superb *thistle*, and instinctively uttering a cry of pain, discovered the assault to the Scots, who ran to their arms, and defeated the foe with a terrible slaughter. The *thistle* was immediately adopted as the insignia of Scotland."

14. Triumphant be the *thistle* still unfurled,
 Dear symbol wild'! on freedom's hills it grows,
 Where Fingal stemmed the tyrants of the world,
 And Roman eagles found unconquer'd foes.—CAMPBELL.

15. But the downy seed of the thistle flower, so light as to be borne about on the wings of every wanton zephyr, *may* also, it seems, be connected with less lofty associations, for it has been made the emblem of fickleness itself, as the following fable will show:

16. As Cupid was flying about one day,
 With the flowers and zephyrs in wanton play,
 He 'spied in the air,
 Floating here and there,
 A winged seed of the thistle flower,
 And merrily chased it from bower to bower.
17. And young Love cried to his playmates, "See,
 I've found the true emblem flower for me,
 For I am as light
 In my wavering flight
 As this feathery star of soft thistle-down,
 Which by each of you zephyrs about is blown.
18. "See how from a rose's soft warm blush
 It flies, to be caught in a bramble bush;
 And as oft do I,
 In my wand'rings, hie
 From beauty to those who have none, I trow;
 Reckless as thistle-down, on I go."
19. So the sly little god still flits away
 'Mid earth's loveliest flow'rets, day by day;
 And oh! maidens fair,
 Never weep, nor care
 When his light wings waft him beyond your power,
 Think—'tis only the down of the thistle flower.—TWAMLEY.

20. In all ages of the world history and fable have attached to flowers particular associations, and made them emblematical of the affections of the heart and qualities of the intellect. In the symbolical language of flowers, the thistle, regarded as a misanthrope,⁵ bears the very appropriate motto, "Oh that the desert were my dwelling-place!"

¹ MON-O-PÉT'-AL-ous plants are those whose³ PHŒ'-BUS (*fé'-bus*), the sun.
 flowers have but one petal or flower leaf. ⁴ HĀLES, drags.

² HĒS'-PER, Venus, or the evening star. ⁵ MĪS'-AN-THŔÔPE, a hater of mankind.

LES. XI.—JESSAMINE,¹ HONEYSUCKLE, AND HEATH FAMILIES.[EXOGENOUS OR DICOTYLEDONOUS; Angiosperms; *Monopetalous*.]

Honeysuckle Family.

Jessamine Family.

1. *Jasmi'num sambac*, Single Arabian jasmine, ii. 1, w., 6 f., J.-D., E. Indies. 2. *J. trifolia'tum*, Double Tuscan jasmine, ii. 1, w., 6 f., J.-D., E. Indies. 3. *J. fru'ticans*, Common yellow jasmine, ii. 1, y., 3 f., A.-O., S. Europe. 4. *J. revolu'tum*, Curl-flowered jasmine, ii. 1, y., 12 f., M.-O., E. Indies. 5. *Lonic'ra sempervi'rens*, Trumpet honeysuckle, v. 1, r. and y., 15 f., My.-Au., N. Am. 6. *L. perich'ymentum*, Woodbine, v. 1, 20 f., My.-Jl., Britain. 7. *L. fla'ra*, Yellow honeysuckle, v. 1, y., 10 f., My.-Jn., Carolina. 8. *L. ru'bra*, Italian honeysuckle, v. 1, r., 10 f., My.-Jl., Italy.

1.

AND luxuriant above all,

The *jasmine*,¹ throwing wide her elegant sweets,

The deep dark green of whose unvarnish'd leaf

Makes more conspicuous, and illumines more

The bright profusion of her scatter'd stars.—COWPER.

2. About one hundred species of ornamental shrubs, with exquisitely fragrant flowers, belong to the jessamine family. Originally tropical plants, they are now extensively cultivated in our gardens and green-houses. *Fragnance*, their predominant property, has made them for ages the favorites of poets and of the people. The very name comes from a Greek word which means *perfume*. The white jessamine especially, from which a costly oil is extracted, is very fragrant at night. Some of the species open only during the night, and fade at sunrise; and it is to these that Moore alludes in the following lines:

3. “'Twas midnight; through the lattice, wreathed
 With woodbine, many a perfume breathed
 From plants that wake when others sleep;
 From timid jasmine buds that keep
 Their odor to themselves all day;
 But, when the sunlight dies away,
 Let the delicious secret out
 To every breeze that roams about.”

4. A twining evergreen plant, improperly called *Jessamine*, grows abundantly in the Southern States south of Richmond, Virginia, spreading over the hedges, and, in still more southern latitudes, hanging in graceful festoons from the tallest trees. It is said that children are frequently poisoned by chewing its pretty yellow flowers. This is the *gelsémium*, and has five stamens, by which it may be known from the true jessamine, which has only two.

5. The *honeysuckle* or *woodbine* family embraces over two hundred species of mostly twining plants, valuable in the flower garden, shrubbery, and against walls and over arbors. The honeysuckle, “which is fair as fragrant,” is so much cultivated that it has almost become a domestic in every household.

6. “See the honeysuckle twine
 Round the casement: 'tis a shrine
 Where the heart doth incense give,
 And the pure affections live.
 Blessed shrine! dear, blissful home!
 Source whence happiness doth come!
 Round the cheerful hearth we meet
 All things beauteous—all things sweet.”

7. It was said, in an ancient fable, that this feeble plant, rapidly shooting into the air, aimed to overtop the oak, the king of the forest; but, as if its efforts were unavailing, it soon recoiled, and with graceful negligence adorned its friendly supporter with elegant festoons and perfumed garlands. In this same family are included the elder, snowberry, and snowball—the latter being known by some as the *Guelder-rose*. Thus that popular writer, Miss Landon, alludes to its blossoms as

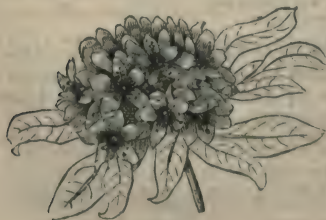
- “The balls that hang like drifted snow
 Upon the *Guelder-rose*.”

8. What is known as the *swamp honeysuckle* in the United States is a species of *azālea*, which belongs to the numerous and eminently beautiful family of the HEATHS. The low shrubby heaths, which form one division of this family, are alike the glory of Southern Africa, and of Scottish plains and hill-sides; and their culture and propagation are now considered, in England, one of the most delicate and delightful branches of the art of gardening. In a second division of the heath

[HEATH FAMILY.—EXOGENOUS OR DIOCOTYLEDONOUS; Angiosperms; *Monopetalous*.]

1. *Eri'ca tet'ralix*, Cross-leaved heath, viii. 1, pk., 1 f., Jn.-Au., Scotland. 2. *Eri'ca cilia'ris*, Ciliated heath, viii. 1, pu., 1 f., Jl.-S., Portugal. 3. *Eri'ca cruen'ta*, Bloody-flowered heath, viii. 1, dark red, 2 f., My.-S., S. Africa. 4. *Eri'ca fascicu'la'ris*, Cluster-flowered heath, viii. 1, pu., 18 in., F.-Jn., S. Africa. 5. *Eri'ca ar'dens*, Glowing heath, viii. 1, sc., 2 f., A.-Jn., S. Africa. 6. *Vaccin'ium resino'sum*, Black whortleberry, x. 1, gr., r., and y., 4 f., My.-Jn., N. Am. 7. *Gaulthe'ria procum'bens*, Spicy wintergreen, x. 1, w., 6 in., Jl.-S., N. Am. 8. *Aza'lea nudiflo'ra*, Swamp honeysuckle, v. 1, pk., 4 f., My.-Jn., N. Am. 9. *Kal'mia latifo'lia*, Broad-leaved laurel, x. 1, w. and r., 8 f., My.-Jl., N. Am. 10. *Kal'mia angustifo'lia*, Sheep laurel, x. 1, r., 5 f., My.-Jl., N. Am.

family we find the lowly trailing arbutus and wintergreen; a third division is famous for the plants which produce our cranberries and whortleberries;² while a fourth embraces those native kalmias and rhododendrons* of American forests, which have latterly become the pride of European gardens. It is a species of the rhododendron which Emerson describes in the following lines under the name of *rhodōra*:



* The *Rhododendron maximum*, or American Rose Bay-tree (x. 1, 20 f., rose-colored flowers), is an evergreen tree, although it renews its leaves once in two or three years. It flowers from May to August, and is found from Long Island to Florida, generally on the borders of rivers or creeks; and on the sides of mountain torrents in Virginia it is so abundant as to form impenetrable thickets.

The *Kalmias*, sometimes called *Laurels* in America, are not the true Laurels. The *Kal'mia latifo'lia*, or Calico bush, which is found on barren hills from the Carolinas to New York, is an elegant shrub, but of noxious qualities—poisonous to cattle and sheep.

9. "In May, when sea-winds pierced our solitudes,
I found the fresh rhodōra in the woods,
Spreading its leafless blooms in a damp nook,
To please the desert and the sluggish brook;
The purple petals, fallen in the pool,
Made the black waters with their beauty gay;
Here might the redbird come his plumes to cool,
And court the flower that cheapens his array.
10. Rhodōra! if the sages ask thee why
This charm is wasted on the marsh and sky',
Dear, tell them that if eyes were made for seeing,
Then beauty is its own excuse for being.
Why thou wert there, oh rival of the rose! I
I never thought to ask, I never knew;
But in my simple ignorance suppose
The self-same Power that brought *me* there', brought *you*'."

11. In Scotland the poorer people cover their cabins with *hēath*, and the hardy Highlanders often make their beds of it; hence frequent allusions to these facts occur in Scottish poetry. In Scott's *Lady of the Lake*, Ellen, the maid of the Highlands, thus addresses the errant³ Fitz James:

"Nor think you unexpected come
To yon lone isle, our desert home;
Before the *hēath* had lost the dew,
This morn a couch was pull'd for you;"

and when the stranger was hospitably introduced to her father's hall, it was through the porch to which

"Wither'd *hēath* and rushes dry
Supplied a russet canopy;"

and further, the poet, still drawing a faithful picture of Highland life, tells us that, after every courteous rite had been paid,

"The stranger's bed
Was there of mountain *hēather* spread,
Where oft a hundred guests had lain,
And dream'd their forest sports again."

¹ Written both JĀs'-MĪNE and JĒs'-SA-MĪNE; ² WHŌr'-TLE-BĒR-RY (*haur'-tl-bēr-e*). chiefly the former in poetry. ³ ĒR'-RANT, wandering; roving.

THE PSYCHOLOGY OF FLOWERS.

The psychology¹ of flowers has found many students, than whom not one read them more deeply than that mild spirit (Shelley) who sang of the sensitive plant, and in wondrous music foreshadowed his own misdirected genius and his melancholy fate. That martyr to sensibility, Keats, who longed to feel the flowers growing above him, drew the strong inspiration of his volant² muse from those delicate creations which exhibit the passage of inorganic matter into life; and other poets will have their sensibilities awakened by the æsthetics³ of flowers, and find a mirror of truth in the crystal dew-drop which clings so lovingly to the purple violet.—HUNT'S *Poetry of Science*.

¹ PSY-CHŌL'-Ō-ĜY, the doctrine of the mind; ² ÆS-THĒT'-ICS, the science which treats of the beautiful; the philosophy of the fine arts.
³ VŌ'-LĀNT, "flying;" active; airy.

LES. XII.—LABIATE AND TRUMPET-FLOWER FAMILIES.

[EXOGENOUS OR DICOTYLEDONOUS; Angiosperms; Monopetalous.]¹

Trumpet-flower Family.

Labiata Family.

1. *Eceremocarpus longiflorus*, Long-flowered eceremocarpus, xiii. 2, or., 6 f., Jl.—Au., Peru. 2. *Chelone centranthifolia*, California trumpet-flower, xiii. 2, sc., 7 f., Jl.—Au., Cal. 3. *Bignonia grandiflora*, Large bignonia, xiii. 2, or., 30–100 f. (cultivated), Jl.—Au., —. 4. *Bignonia echinata*, xiii. 2, pk., 30 f., Guiana. 5. *Catalpa cordifolia*, Common catalpa, ii. 1, w. and y., 20 f., Jn.—Au., N. Am. 6. *Salvia fulgens*, Scarlet salvia, ii. 1, sc., 5 f., Au.—O., Mexico. 7. *Lavandula stoechas*, French lavender, xiii. 1, li., 18 in. My.—Jl., S. Europe. 8. *Marubium vulgare*, Common horehound, xiii. 1, w., 2 f., Jn.—S., N. Am. 9. *Thymus serpyllium*, Wild thyme, xiii. 1, pu., 3 in., Jn.—Au., Europe. 10. *Thymus vulgaris*, Garden thyme, xiii. 1, pu., 12 in., My.—Au., cultivated, —.

1. THE plants of the Labiate family, which number nearly twenty-four hundred species, are easily distinguished by the *labiate* or lip-like form of their monopetalous¹ corollas. Natives, chiefly, of temperate regions, they are found in abundance in hot, dry, exposed situations, in meadows, groves, and by the wayside, and but seldom in marshes. They are, for the most part, fragrant and aromatic;² some, as the sage, hyssop, thyme,³ and savory, are valuable as kitchen herbs, for sauces, and flavoring cooked dishes; some, like the mints, lavenders, and rosema-



1, a trumpet-flower, *Bignonia rigescens*. 2, a labiate flower, Garden sage.

ry, are employed by perfumers; others, like the exotic *salvias*, are admired and extensively cultivated for their beauty.

2. Many of the plants of this family were formerly deemed valuable as medicines, and frequent allusions to their medicinal virtues are made by the poets. Thus *rosemary* was formerly recommended for diseases of the nervous system, for the removal of headaches, and also for strengthening the memory. Hence the allusion of Shakspeare, "There's rosemary: that's for remembrance." With the Greeks, the plant *thyme* was the emblem of *activity*, doubtless because its honeyed fragrance made it a favorite with all the cheerful, busy little tenants of the air, who are continually on the wing around it, making the most of the brief time allotted to their ephemeral existence.

3. The Trumpet-flower family, which consists of trees, shrubs, or occasionally herbs, often twining or climbing, most abounds in tropical regions; but native species are found in our country as far northward as Pennsylvania; and others, like the catalpa-tree, and the bignonias, are cultivated still farther north. The various species are most celebrated for the great beauty of their trumpet-shaped flowers, which, from their large size, gay colors, and great abundance, are often among the most striking objects in a tropical forest.

¹ MON-O-PĒT'-AL-ŌUS, having a corolla of a² AR-O-MĀT'-IC, spicy; strong-scented.
single pĕtal.

³ THĒME (pronounced tĕme).

LESSON XIII.—FOREST TREES.

1. I AM fond of listening to the conversation of English gentlemen on rural concerns, and of noticing with what taste and discrimination, and with what strong, unaffected interest, they will discuss topics which, in other countries, are abandoned to mere woodmen or rustic cultivators. I have heard a noble earl descant¹ on park and forest scenery with the science and feeling of a painter. He dwelt on the shape and beauty of particular trees on his estate with as much pride and technical precision as though he had been discussing the merits of statues in his collection. I found that he had gone considerable distances to examine trees which were celebrated among rural amateurs;² for it seems that trees, like horses, have their established points of excellence, and that there are some in England which enjoy very extensive celebrity from being perfect in their kind.

2. There is something nobly simple and pure in such a taste.

It argues, I think, a sweet and generous nature to have this strong relish for the beauties of vegetation, and this friendship for the hardy and glorious sons of the forest. There is a grandeur of thought connected with this part of rural economy. It is, if I may be allowed the figure, the heroic line of husbandry. It is worthy of liberal, and free-born, and aspiring men. He who plants an oak looks forward to future ages, and plants for posterity. Nothing can be less selfish than this. He can not expect to sit in its shade nor enjoy its shelter; but he exults in the idea that the acorn which he has buried in the earth shall grow up into a lofty pile, and shall keep on flourishing, and increasing, and benefiting mankind long after he shall have ceased to tread his paternal fields.—W. IRVING.

¹ DES-CANT', discourse upon; make a variety of remarks. | ² AM-A-TEUR', an unprofessional cultivator of a study or art.

LESSON XIV.—THE OAK FAMILY.

[EXOGENOUS OR DICOTYLEDONOUS; Angiosperms; *Apetalous*.]¹



1. *Quercus phellos*, Willow oak, xix. 12, (ap.), 60 f., My.-Jn., N. Am. 2. *Q. virens*, Live oak, xix. 12, (ap.), 40 f., My., —. 3. *Q. imbricaria*, Shingle oak, xix. 12, (ap.), 40 f., My.-Jn., N. Am. 4. *Q. bicolor*, White swamp oak, xix. 12, (ap.), 60 f., My., N. Am. 5. *Q. alba*, White oak, xix. 12, (ap.), 80 f., My., N. Am. 6. *Q. rubra*, Red oak, xix. 12, (ap.), 70 f., My., N. Am. 7. *Castanea vesca*, Common chestnut, xix. 12, g., 60 f., My.-Jn., N. Am. 8. *Osrya vulgaris*, Hop hornbeam, xix. 12, (ap.), 30 f., My.-Jn., Italy. (The American hornbeam has an acute bud, and more pointed leaves.) 9. *Fagus ferruginea*, Red beech, xix. 12, (ap.), 50 f., My.-Jn., N. Am. 10. *Platanus occidentalis*, button-wood, sycamore, or plane-tree, xix. 12, (ap.), 70 f., A.-My., N. Am.

1. THE monarch oak, the patriarch of the trees,
Shoots slowly up, and spreads by slow degrees ;
Three centuries he grows, and three he stays
Supreme in state, and in three more decays.—DRYDEN.

2. "The oak, for grandeur, strength, and noble size,
Excels all trees that in the forest grow :
From acorn small, that trunk, those branches rise,
To which such signal benefits we owe.
Behold what shelter in its ample shade,
From noontide sun, or from the drenching rain ;
And of its timber stanch, vast ships are made,
To sweep rich cargoes o'er the watery main."

3. The illustrious Oak family includes not only the trees usually called oak, but also the chestnut, beech, hornbeam or iron-wood, and hazel or filbert. It embraces two hundred and sixty-five species, mostly forest trees of great size. According to ancient legends, the fruit of the oak served as nourishment for the early race of mankind. This tree was said to have shaded the cradle of Jupiter after his birth on Mount Lycæus, in Arcadia, and, after that, to have been consecrated to him.

4. Among the Romans, the highest reward was the civic crown, made of oak leaves, given to him who had saved the life of a citizen in battle.

Most worthy of the oaken wreath
The ancients him esteemed
Who in a battle had from death
Some man of worth redeemed.—DRAYTON.

The person who received it was entitled to wear it at all public spectacles, and to sit next to the senators ; and when he entered crowned with oak leaves, the audience rose up as a mark of respect.

5. By the early inhabitants of Britain, also, the oak was held in great veneration, and it was within its consecrated groves that

"The Druid, erst his solemn rites performed,
And taught to distant realms his sacred lore."

Cowper, in his poem to the Yardley Oak, thus alludes to the Druidical worship :

"It seems idolatry with some excuse',
When our forefather Druids in their oaks
Imagined sanctity'. The conscience, yet
Unpurified by an authentic act
Of amnesty', the meed of blood divine',
Loved not the light', but, gloomy, into gloom
Of thickest shades', like Adam after taste
Of fruit proscribed', as to a refuge fled'."

6. The white oak, red oak, and live oak are the most important species, the timber of the latter being the best for ship-building. The live oak grows in the Southern States, within twenty miles of the sea-coast, and may be seen as far

north as Old Point Comfort, in Virginia. Other species, as water, black, willow, and shingle oaks, abound in various sections of the country. It is a common sentiment that the more the oak is rocked by winds, the more firmly knit are its branches, and that the storm which scatters its leaves only causes its roots to strike the deeper into the earth.

The graceful foliage storms may reave,
The noble stem they can not grieve.—SCOTT.

It grew and it flourish'd for many an age,
And many a tempest wreak'd on it its rage;
But when its strong branches were bent with the blast,
It struck its roots deeper, and flourish'd more fast.—SOUTHEY.

In the following lines an anonymous writer has given to the subject a moral application.

7. "Proud monarch of the forest'!
That once, a sapling bough,
Didst quail far more at evening's breath
Than at the tempest now',
Strange scenes have pass'd, long ages roll'd
Since first upon thy stem,
Then weak as osier twig, Spring set
Her leafy diadem'.
8. To thee but little reck's it
What seasons come or go';
Thou lov'st to breathe the gale of spring
And bask in summer's glow';
But more to feel the wintry winds
Sweep by in awful mirth,
For well thou know'st each blast will fix
Thy roots more deep in earth.
9. Would that to me life's changes
Did thus with blessings come'!
That mercies might, like gales of spring,
Cause some new grace to bloom'!
And that the storm which scattereth
Each earth-born hope abroad',
Might anchor those of holier birth
More firmly on my God!"

10. Oaks live to a great age. The famous Charter Oak of Hartford, Connecticut, which fell August 21st, 1856, must have been a goodly tree when William the Conqueror was planting the new forest in England. When the first settlers of the state were clearing the forests, the Indians begged that it might be spared. How appropriate to their entreaties seem the words of Morris:

"Woodman, forbear thy stroke!
Cut not its earth-bound ties;
Oh, spare that aged oak,
Now towering to the skies!"

11. "It has been the guide of our ancestors for centuries," said they, "as to the time of planting our corn. When the leaves are the size of a mouse's ears, then is the time to put the seed into the ground." And it was well they did "let the old oak stand," for it afterward became the faithful guard-

ian of the chartered rights of the infant colony ; and so highly was it venerated, that, at sunset on the day of its fall, the bells of the city were tolled, and a band of music played funeral dirges over its fallen ruins.

12. The chestnut, also one of the Oak family, is, like the oak, remarkable for its long life and great size, but is best known for its excellent fruit. —As a noble shade-tree it is unsurpassed, and as such has been immortalized in the affections of our people by a popular poem beginning,

Under a spreading *chestnut-tree*
The village smithy stands,
The smith, a mighty man is he,
With large and sinewy hands ;
And the muscles of his brawny arms
Are strong as iron bands.—LONGFELLOW.

This tree is not, however, the same as the well-known ornamental lawn-tree, the *horse-chestnut*, which belongs to another family.

13. The beech—"the spreading beech-tree"—also a member of the Oak family, is a tree of firm and hard wood, which is much used for making carpenters' tools. The botanical name of the tree, *fagus*, is supposed to be derived from a Greek word signifying *to eat*, indicating that its fruit served as food for man in ancient times. Our American Indians were so firmly persuaded that this tree was never struck by lightning, that, on the approach of a thunder-storm, they took refuge under its thick foliage with a full assurance of safety.

14. The bark of the beech is smooth, and of a silvery hue, and very well adapted to rude carving ; and doubtless this is the chief reason of the poetic celebrity which this tree has attained. Virgil has given it immortal bloom in the opening of his first Eclogue :

"In beechen shades, you, Tityrus, stretched along,
Tune to your slender reed the sylvan song ;"

and Shakspeare thus notices it in his comedy of "As You Like It :"

"Oh Rosalind ! these trees shall be my books,
And in their barks my thoughts I'll character,
That every eye which in this forest looks
Shall see thy virtue witness'd every where."

15. The poet Campbell has appropriated a distinct poem to "The Beech-tree's Petition"—the last few lines of which will close our notice of this tree of poetic celebrity :

"Thrice twenty summers I have stood
In bloomless, fruitless solitude,
Since childhood in my nestling bower
First spent its sweet and sportive hour,
Since youthful lovers in my shade
Their vows of truth and rapture paid,

And on my trunk's surviving frame
 Carved many a long-forgotten name.
 Oh, by the vows of gentle sound
 First breathed upon this sacred ground,
 By all that Love hath whisper'd here,
 Or beauty heard with ravish'd ear—
 As Love's own altar, honor me,
 Spare, woodman, spare the *beechen-tree* !¹

¹ A-PÉT'-AL-ŌUS plants are those whose flowers have no petals, or corolla.

LESSON XV.—THE OAK AND THE NOBLEMAN.

AND, on the rugged mountain brow exposed,
 Bearing the blast alone, the ancient *oak*
 Stood, lifting his mighty arm, and still,
 To courage in distress, exhorted loud.—POLLOCK.

There is an affinity between all natures, animate and inanimate. The oak, in the pride and lustihood of its growth, seems to me to take its range with the lion and the eagle, and to assimilate, in the grandeur of its attributes, to heroic and intellectual man. With its lofty pillar rising straight and direct toward heaven, bearing up its leafy honors from the impurities of earth, and supporting them aloft in free air and glorious sunshine, it is an emblem of what a *true nobleman* should be: a refuge for the weak, a shelter for the oppressed, a defense for the defenseless; warding off from the peltings of the storm, or the scorching rays of arbitrary power. He who is this is an ornament and a blessing to his native land. He who is otherwise abuses his eminent advantages—abuses the grandeur and prosperity which he has drawn from the bosom of his country. Should tempests arise, and he be laid prostrate by the storm, who would mourn over his fall? Should he be borne down by the oppressive hand of power, who would murmur at his fate? “WHY CUMBERETH HE THE GROUND?”—WASHINGTON IRVING.

LESSON XVI.—THE ELM, WILLOW, AND BIRCH FAMILIES.

1. THE numerous species of trees of the Elm, Willow, and Birch families, as well as those of the Oak, Chestnut, Beech, and many others of our large forest trees, are classed by most botanists as *apetalous*, because, while they have all the essential organs which constitute a flower, such as stamens, pistils, and seed vessels, they are destitute of *petals*, or corolla. Many of them have a colored calyx, but in some even the calyx itself is wanting.

2. The *elms*, of which sixty species have been described by botanists, are believed by many to have originated from only

[EXOGENOUS OR DICOTYLEDONOUS; Angiosperms; *Apetalous*.]

1. *Ulmus campestris*, English elm, now abundant in this country, v. 2, (ap.), 80 f., A.-My., Britain. 2. *Salix triandra*, Long-leaved willow, xx. 2, (ap.), 30 f., My.-Au., Britain. 3. *Salix rubra*, Green osier, xx. 2, (ap.), 8 f., A.-My., England. 4. *Salix rosmarinifolia*, Rosemary willow, xx. 2, (ap.), 3 f., A.-My., N. Am. 5. *Populus alba*, Abule tree, xx. 8, (ap.), 40 f., M.-A. (introduced). 6. *Populus nigra*, Black poplar, xx. 8, (ap.), 30 f., M.-A., Britain. 7. *Populus monilifera*, Canadian poplar, xx. 8, (ap.), 70 f., My., N. Am. 8. *Populus tremula*, Aspen, xx. 8, (ap.), 50 f., A.-Jn., Britain. 9. *Betula alba*, Common birch, xix. 12, (ap.), 40 f., A.-Jn., Britain. 10. *Betula lenta*, Mountain mahogany, black birch, or sweet birch, xix. 12, (ap.), 50 f., My.-Jn., N. Am. 11. *Salix Babylonica*, Weeping willow, xx. 2, (ap.), 40 f., My., Levant.



Elm in blossom.

two distinct kinds, the lowland and the mountain elm. Certain it is that the elm, like the apple, has a remarkable tendency to produce new varieties from the seed; and if a bed be sown with the seeds, some of the plants will have large leaves, and some small ones; some will be early, and others late; and some will have smooth bark, and others rough.

3. The ancient poets frequently mention the elm. The Greeks and Romans considered all as funeral trees which produced no fruit fit for the use of man. Homer alludes to this when he tells us, in the *Iliad*, that Achilles raised a monument to the father of Andromache in a grove of elms:

“Jove's sylvan daughters bade their elms bestow
A barren shade, and in his honor grow.”

4. So generally, among the Romans, was the elm used as

a prop to the vine, that the one was considered by the poets inseparable from the other.

"If that fair elm," he cried, "alone should stand,
No grapes would glow with gold, and tempt the hand;
Or if that vine without her elm should grow,
'Twould creep, a poor neglected shrub, below."—OVID.

And finally, the poet Cowper, in the "Task," very accurately sketches the varieties of form in the elm, alludes to the different sites where it is found, and describes an enchanting scene, where a lowly cot, "perched upon the green hill-top," is

"Environ'd with a ring of branching elms
That overhang the thatch."

5. The elm is the favorite shade-tree in the villages of New England. In the centre of the public square, in the beautiful village of Pittsfield, in Massachusetts, there stands alone, in all its majesty, encircled by a new generation of lesser trees, a venerable old elm, which measures one hundred and twenty-eight feet in height, with a trunk thirteen feet and nine inches in circumference at a yard from the ground, and ninety feet to the lowermost limbs. Many interesting incidents in the history of the country are associated with this much-revered and ancient tenant of the soil. It was beneath its shade that the Berkshire troops were marshaled previous to their march to Bunker Hill; and the first agricultural fair in America was held under its boughs. It was somewhat injured by lightning in the year 1841.

6. Hail to the elm! the brave old elm!
 Our last lone forest tree,
Whose limbs outstand the lightning's brand,
For a brave old elm is he!
For fifteen score of full-told years
He has borne his leafy prime,
Yet he holds them well, and lives to tell
His tale of the olden time!
Then hail to the elm! the green-topp'd elm!
And long may his branches wave,
For a relic is he, the gnarl'd old tree,
Of the times of the good and brave.—N. S. DODGE.

7. The willow and poplar, which are examples of the *Willow family*, are distinguished as being the largest members in a numerous class which have separate staminate and pistillate flowers on different plants. Willows generally grow on the banks of streams; and some of the smaller cultivated species, called *osiers*, are used for hoops, basket-work, and for thatching. Most of the species are easily recognized in the flowering season by their long, pendulous, and frequently *downy* spikes or clusters of flowers, called *catkins*. The blossoms of some of the water-willows, with their little knots of golden down, present a very beautiful appearance.

"The *watery willow's* spray, emboss'd
 With oval knots of silken down;
 Which soon, in form of papal crown,
 Shall decorate the russet stem
 With many a golden diadem."

8. The weeping or *Babylonian* willow, so celebrated for its drooping foliage, received its botanical name, *Salix Babylonica*, from Linnæus, in allusion to the 137th Psalm, where the Jews, in their captivity, are represented as sitting down by the waters of Babylon, and weeping, having hung their harps upon the willows, while their oppressors required of them one of the songs of Sion.

"By Babel's stream the captives sat,
 And wept for Sion's hapless fate,
 Useless their harps on willows hung,
 While foes required a sacred song."
 On the willow that harp is suspended,
 Oh Salem! its sound should be free;
 And the hour when thy glories were ended
 But left me that token of thee:
 And ne'er shall its soft tones be blended
 With the voice of the spoiler by me.—BYRON.

9. The poplar is a member of the Willow family. Like the willow it is easily propagated, growing readily where a green twig is thrust into moist earth. A tree called the tulip poplar, or tulip-tree, common in this country, does not belong to this family. Popular tradition states that the cross was made from the *aspen* or poplar-tree, and that since the Passion of our Savior the leaves have never known rest. The vibratory motion of the leaves is indeed curious, and never fails to attract the attention of the observer. It arises from the length and slenderness of the footstalks to which they are attached.

10. "Why tremble so', broad *aspen-tree*'?
 Why shake thy leaves ne'er ceasing'?
 At rest thou never seem'st to be',
 For when the air is still and clear',
 Or when the nipping gale, increasing,
 Shakes from thy boughs soft twilight's tear',
 Thou tremblest still', broad *aspen-tree*',
 And never tranquil seem'st to be'."

11. The family of *Birches* is very small, being confined principally to the cooler parts of the northern hemisphere. One species, called the paper birch, furnished the Indians of America the bark of which they made their canoes. The elegance of its appearance has given it the appellation of "Lady of the Woods," and it is very properly considered the emblem of gracefulness.

12. "Oh! come to the woodlands, 'tis joy to behold
 The new-waken'd buds in our pathway unfold;
 For spring has come forth, and the bland southern breeze
 Is telling the tale to the shrubs and the trees,
 Which, anxious to show her
 The duty they owe her,
 Have decked themselves gayly in em'rald and gold.

13. But, though beautiful each, sure the fairest of all
Is yon *birch*, that is waving so graceful and tall:
How tender, yet bright, is the tint that is flung
O'er its delicate spray, which so lightly is hung,
That, like breeze of the mountain,
Or gush of the fountain,
It owns not of rest or of slumber the thrall."

14. The "*birch-tree*" is very prettily introduced in Longfellow's poem of *Hiawatha*, from which we make the following extract:

HIAWATHA'S CANOE.

- "Give me of your bark, O birch-tree!
Of your yellow bark, O birch-tree!
Growing by the rushing river,
Tall and stately in the valley!
I a light canoe will build me,
That shall float upon the river
Like a yellow leaf in autumn,
Like a yellow water-lily.
Lay aside your cloak, O birch-tree!
Lay aside your white-skin wrapper;
For the summer time is coming,
And the sun is warm in heaven,
And you need no white-skin wrapper."
15. Thus aloud cried Hiawatha
In the solitary forest,
When the birds were singing gayly,
In the moon of leaves were singing:
And the sun, from sleep awaking,
Started up, and said, 'Behold me!
And the tree, with all its branches,
Rustled in the breeze of morning,
Saying, with a sigh of patience,
'Take my cloak, O Hiawatha!
With his knife the tree he girdled;
Just beneath its lowest branches,
Just above the roots he cut it,
Till the sap came oozing outward;
Down the trunk, from top to bottom,
Sheer he cleft the bark asunder;
With a wooden wedge he raised it,
Stripped it from the trunk unbroken."

LES. XVII.—THE CONE-BEARING, OR PINE FAMILY.

1. In the cone-bearing, or Pine family, exogenous plants assume a new character, in having their seeds uncovered. Like the elm, willow, and birch, their flowers have no corolla: in some species the pistillate and staminate flowers are on the same plant, and in others on different plants, while in other particulars their inflorescence is often irregular, and seemingly imperfect. Yet here we find some of the noblest specimens of the vegetable kingdom; and no other family is of more importance to mankind than this, whether we view it with reference to its timber or its secretions.

2. Many of the trees of this family are gigantic in size, rap-

[EXOGENOUS OR DICOTYLEDONOUS; Gymnosperms; ¹ *Aptalous*.]

1. *Pinus Canadensis*, Hemlock or Hemlock spruce, xix. 15, (ap.), 50 f., My., N. Am.
 2. *Pinus strobus*, White or Weymouth pine, xix. 15, (ap.), 50–100 f., My., N. Am. 3. *Pinus pinea*, Stone pine, xix. 15, (ap.), 40 f., My., Italy. 4. *Pinus* or *Abies communis*, Common fir or Norway spruce, xix. 15, (ap.), 100 f., A., N. Europe. 5. *Pinus* or *Abies rubra*, Red spruce, xix. 15, (ap.), 50 f., A., N. Am. 6. *Larix cedrus*, Cedar of Lebanon, xix. 15, (ap.), 60 f., A., W. Asia. 7. *Cupressus thyoides*, White cedar or cypress, xix. 15, (ap.), 20 f., A., N. Am. 8. *Thuja occidentalis*, American arbor-vitæ, xix. 15, (ap.), 25 f., A., N. Am. 9. *Juniperus Virginia'na*, Red cedar, xx. 15, (ap.), 30 f., My.—Jn., N. Am. 10. *Taxus baccata*, Common yew, xx. 15, (ap.), 20 f., A., Britain.

id in growth, noble in aspect, robust in constitution; and they form a considerable proportion of woods or plantations in cultivated countries, and of forests where nature remains, in temperate countries, in a savage state. Their timber, in commerce, is known under the names of deal, fir, pine, and cedar; and is principally the wood of the spruce, the larch, the Scotch fir, the white or Weymouth pine of Vermont, and the Virginian cedar. Some of the pines of Northwest America are stupendous trees, attaining a height of two hundred and fifty feet. Those products called naval stores, such as tar, turpentine, pitch, together with numerous resins and balsams, are obtained from the Pine family.

3. The cone-bearing trees are not only of great value in ship-building, but in all structures in which durability is desired. From the wood of the juniper the Greeks carved the images of their gods; the wood of the arar-tree of Barbary is considered by the Turks indestructible, and on this account they use it for the ceilings and floors of their mosques; and

the gates of Constantinople, famous for having stood from the time of Constantine to that of Pope Eugene IV., a period of eleven hundred years, were of cypress. The cedar of Lebanon is, perhaps, the most celebrated tree of the whole family, yet it is now scarce on Mount Lib'anus, whose forests seem never to have recovered from the havoc made by Solomon's four score thousand hewers. The seeds of the stone pine, which are as sweet as almonds, are eaten throughout Italy.

4. As ornamental lawn-trees, the larch, the spruce, the fir, the cypress, are unequaled; and the hemlock-spruce and arbor vitæ are great favorites for hedges. Well-grown belts of evergreens, which

"in conic forms arise,
And with a pointed spear divide the skies,"

afford a fine protection for gardens in exposed situations, and are often planted, in the Northern States, for that purpose. The fact that a plaintive sound, solemn and sad, is produced by the passage of the wind through the leaves of the pine, is notorious to all observers. Virgil alludes to this music in his eighth Eclogue:

"Begin with me, my pipe, Mænalian strains,
Delightful Mænalus, mid *echoing groves*
And *vocal pines*."

5. The poet Hood has, with characteristic humor, described a group of pines, with interlacing branches, writhing in the storm like Laocoon² in the folds of the serpents, and weeping gummy tears.

"The pines—those old gigantic pines,
That writhe—recalling soon
The famous human group that writhes
With snakes in wild festoon—
In *rimous*³ *wrestlings* interlaced,
A forest Laocoon'—
Like Titans of primeval girth
By tortures overcome,
Their brown enormous limbs they twine,
Bedewed with tears of gum."

6. Of the associations connected with this family, it may be remarked that the cypress especially, on account of the gloomy hue of its leaves, was esteemed by the ancients a suitable ornament of their burial-places, and that it is often alluded to in poetry as the emblem of mourning.

Peace to the dust that in silence reposes
Beneath the dark shades of cypress and yew;
Let spring deck the spot with her earliest roses,
And heaven wash their leaves with its holiest dew.—PREFONT.



Dark tree ! still sad when others' grief is fled,
The only constant mourner of the dead.—BYRON.

- ¹ GYM'-NO-SPERMS are plants that have naked seeds, such as the pines. | here departs from the classical pronunciation, which is LÄ-oo'-o-ön. See p. 70 and 72.
² LÄ-O-CÖÖN'. It will be seen that the poet | ³ RÄ'-MOUS, branched; full of branches.

LESSON XVIII.—TO A PINE-TREE.

1. FAR up on Katahdin thou towerest,
Purple-blue with the distance, and vast;
Like a cloud o'er the lowlands thou lowerest,
That hangs poised on a lull in the blast,
To its fall leaning awful.
2. Spite of winter thou keeps't thy green glory,
Lusty father of Titans past number !
The snow-flakes alone make thee hoary,
Nestling close to thy branches in slumber,
And thee mantling with silence.
3. Thou alone know'st the splendor of winter,
'Mid thy snow-silver'd, hushed precipices,
Hearing crags of green ice groan and splinter,
And then plunge down the muffled abysses
In the quiet of midnight.
4. Thou alone know'st the glory of summer,
Gazing down on thy broad seas of forest—
On thy subjects, that send a proud murmur
Up to thee, to their sachem, who towerest
From thy bleak throne to heaven.

JAMES RUSSELL LOWELL.

THE PINE-APPLE. [ENDOGENOUS: see next page.]



Bromelia anaënas, the Pine-apple, vi. 1, pu., 4 f., J.-D., S. America. "This fruit," says Loudon, "may, without hesitation, be pronounced the first in the world, though it has not been known in Europe above two centuries, and has only been cultivated about a century as a fruit plant in Britain." First discovered in Brazil, it passed thence to the East Indies, where it has long been successfully cultivated. Many varieties of the pine-apple have

been produced by cultivation. In the West Indies and South America, one species is used for fencing pasture-lands on account of its prickly leaves.

SECOND DIVISION OF THE VEGETABLE KINGDOM. ENDOGENS.

[The four most important physiological peculiarities of this great natural division are, 1st. The structure is *endogenous* (for which see Fourth Reader, p. 187). 2d. The leaves are straight or *parallel-veined*. 3d. The flowers are *ternary*; that is, have *three* sepals, petals, and stamens, or some power of that number. 4th. The embryo has but one *cotyledon*; that is, the plants are *monocotyledonous*. Other peculiarities will be noticed under the different *families* which compose the division.]

LESSON XIX.—THE IRIS, LILY, AND PALM FAMILIES.

[ENDOGENOUS OR MONOCOTYLEDONOUS; *Agglumaceus*.]¹



Lily Family.

Iris Family.

1. *Iris versicolor*, Blue flag, iii. 1, b., 2 f., My.—Jn., N. Am. 2. *Iris tennax*, California iris, iii. 1, pu., 18 in., A.—My., California. 3. *Iris sambucina*, Flower-de-luce, iii. 1, b., 3 f., Jn., S. Europe. 4. *Tigridia pavonia*, Tiger flower, xv. 3, o. and r., 2 f., Jl.—S., Mexico. 5. *Crocus verus*, Spring crocus, iii. 1, y., 6 in., M., Eng. 6. *Crocus sativus*, Autumn crocus, iii. 1, y., 10 in., S., Eng. 7. *Lilium Japonicum*, Japan lily, vi. 1, w., 2 f., Jl.—Au., China. 8. *Lilium Philadelphicum*, Red lily, vi. 1, r. and y., 5 f., Jl.—Aug., N. Am. 9. *Lilium Canadense*, Nodding lily, vi. 1, r. and y., 4 f., Jl.—Au., N. Am. 10. *Tulipa sylvestris*, Wild tulip, vi. 1, y., 18 in., A.—My., Eng. 11. *Fritillaria imperialis*, Crown Imperial, vi. 1, r. and y., 4 f., My., Persia.

1. CONSPICUOUS among the ENDOGENOUS plants, which constitute the second great division of the vegetable kingdom, are the Iris, Lily, and Palm families, the palm being taken as typical of the endogenous structure. Endogens probably contain more plants contributing to the food of man, and fewer poisonous species in proportion to their whole number,

than Exogens; as the grasses, which include all the cereals, are found here, to which may be added the numerous palms yielding fruit, wine, sugar, sago, the pine-apple, bananas, the arrow-roots, and the gingers.

2. The large and showy tiger flower, the blue flag, flower-de-luce, gladiolus, and the crocus, are good examples of the richly-tinted *Iris* family. The name itself implies that the flowers are rainbow-colored. Among the Greeks, *Iris* was the winged messenger of the gods, and is thus alluded to by Virgil:

“*Iris*, on saffron wings array'd with dew
Of various colors, through the sunbeams flew.”

According to Plutarch, the word *iris* signified, in the ancient Egyptian language, “the eye of heaven,” and was appropriated to this flower because no other name was so expressive of its serene lustre. A modern poet has attributed the naming of the beauty to her sister flowerets.

3

All with their pearls so fair,
The gay flowers wreathed were,
But, 'midst them all,
Crown'd at the rainbow festival,
A sapphire-colored blossom shone
The loveliest there; no other one
Her jewels wore
So gracefully. Her robe all o'er
Was radiant, yet deep blue, like twilight sky,
And softly shaded, as when clouds do lie
Upon the deep expanse. 'Twas strange, none knew
A name for this fair form, so bright and blue:
But sister flowerets fancifully said,
As they to note her beauty had been led
By its enhancement in the rainbow shower,
They e'en would call her *Iris* from that hour.—TWANLEY.

4. “The beautiful creations,” says Lindley, “which constitute the order of Lilies, would seem to be well known to all the world, for what have been so long admired and universally cultivated as they?” The lily is often alluded to as being, among flowers, the emblem of majesty. In heathen mythology it was a great favorite with Juno, and was consecrated to her by heathen nations. The Jews imitated its form in their first magnificent temple, and the Savior described it as more splendid than King Solomon in his most gorgeous apparel.

5.

Observe the rising lily's snowy grace';
Observe the various vegetable race';
They neither toil nor spin, but careless grow;
Yet, see how warm they blush! how bright they glow!
What regal vestments can with them compare?
What king so shining', or what queen so fair'?—THOMSON.

6. Among the flowers of the Lily family, the crown imperial, or *fritillaria*, is noted for its drooping but brilliant tulip-

shaped corollas, which have the appearance of so many gay bells, or crowns. Its golden stigma is very appropriately described as

"The dazzling gem
That beams in fritillaria's diadem."

The *tulip*, another member of the Lily family, is especially noted for a sort of mania among the florists of the seventeenth century, who bought and sold single bulbs at prices amounting to five hundred pounds sterling and upward—in those days an immense sum. Although the taste for tulips has greatly declined since that period, the tulip is still considered by many as "the king of florist's flowers." How highly the poet Montgomery prized it may be gathered from the following lines:

7. "Not one of Flora's brilliant race
A form more perfect can display:
Art could not feign more simple grace,
Nor nature take a line away.
Yet, rich as morn, of many a hue,
When flushing clouds through darkness strike,
The tulip's petals shine like dew,
All beautiful, but none alike."

8. Highest in the division of Endogens stands the Palm family, embracing the stately palm-trees of the tropics, and the palmettos of the Southern States. "The race of plants to which the name of Palms has been assigned," says Lindley, "is, no doubt, the most interesting in the vegetable kingdom, if we consider the majestic aspect of their towering stems, crowned by a still more gigantic foliage; the character of grandeur which they impress upon the landscape of the countries they inhabit; their immense value to mankind, as affording food, and raiment, and numerous objects of economical importance; or, finally, the prodigious development of those organs by which their race is to be propagated. A single spathe or flower-stem of the date palm contains about twelve thousand flowers, and another species has been computed to have six hundred thousand upon a single individual; while every bunch of the seje palm of the Orinoco bears eight thousand fruits."

9. The variety of forms which they exhibit is briefly but well described in the following language of the celebrated traveler Humboldt. "While some have trunks as slender as the graceful reed, or longer than the longest cable, others are three and even five feet thick; while some grow collected in groups, others singly dart their slender trunks into the air; while some have a low stem, others tower to the height of nearly two hundred feet; and while one part flourishes in the

[PALM FAMILY.—ENDOGENOUS OR MONOCOTYLEDONOUS; *Aglumaceous*.]¹

1. *Cor'ypa umbraculif'era*, Great fan palm, or Tallipot palm, vi. 1, y., 100 f., Jl., E. Indies. (The topmost leaves form immense fans, twenty feet long and fifteen wide.) 2. *Sa'gus rum'phii*, Rumphius's sago palm, xix. 6, g., 50 f., Jl.-Au., F. Indies. 3. *Co'cus nucif'era*, Cocoanut palm, xix. 6, g., Jl.-Au., 50 f., E. Indies. 4. *Phoe'nix dactilif'era*, Date palm, xx. 3, w. and g., 50 f., W. Asia. 5. *Ela'is Guineen'sis*, Guinea oil palm, xx. 6, w. and g., 30 f., Guinea. 6. *Chamæ'rops hys'trix*, Porcupine palm, xx. 2, w. and g., 10 f., Georgia.

low valleys of the tropics, or on the declivities of the lower mountains, another part consists of hardy mountaineers, bordering on the limits of perpetual snow."

10. The cocoanut palm, which grows abundantly in the East Indies, supplies nearly every want of the native inhabitants. Travelers have described the uses which the native of Ceylon makes of it. He builds his house of its trunk, and thatches the roof with its leaves. His children sleep in a rude hammock made of the husk of the fruit; his meal of rice and scraped cocoanut is boiled over a fire made of cocoanut shells and husks, and is eaten from a dish of plaited green leaves of the tree, with a spoon cut out of a cocoanut shell.

11. In his canoe, made of the trunk of the palm-tree, he carries a torch of dried palm leaves, and fishes with a net of cocoanut fibre. When thirsty he drinks the juice of the cocoanut, and when hungry eats its soft kernel. He makes a drink called arrack from the fermented juice, and dances to the music of cocoanut castanets. He anoints himself with cocoanut oil, and, when sick, gets his medicine from the tree

so useful to him in health. Over his couch in infancy, and over his grave, a bunch of cocoanut blossoms is hung to charm away evil spirits.

12. Branches of palm were anciently carried in token of victory, but more generally it was reserved for religious triumphs; and from this, as well as from the prominent place it occupies in Holy Writ, we feel the epithet of "celestial palm," bestowed on it by Pope, not inapplicable. No wonder that the Arab loves the palm, which he converts to so many uses—of food, and drink, and raiment, and shelter—and that he places it among the foremost objects of his affections.



Carolina Palmetto.

13. The palmetto, which grows in South Carolina, and farther south, is the only representative of the Palm family north of the Gulf of Mexico. It will be recollected that the fort on Sullivan's Island, so gallantly defended by Colonel Moultrie in 1776, was constructed of palmetto logs, and that, owing to the soft nature of the wood, the balls of the enemy had but little

effect to injure it. The palmetto has been appropriately placed on the coat of arms of South Carolina.

¹ A-GLU-MX'-ONEOUS plants are such as have *not* the glumes or husks which characterize the grains and grasses.

LESSON XX.—SEDGES AND GRASSES.

1. SEDGES are grass-like herbs, growing in tufts, and never acquiring a shrubby condition. So nearly do they resemble grasses in appearance, that the one may be readily mistaken for the other by the inexperienced; but, unlike grasses, the stems of sedges are usually angular, never hollow, and not completely jointed; and, moreover, when the leaf-stalks of sedges surround the stem, they grow together by their edges

[ENDOGENOUS OR MONOCOTYLEDONOUS; *Glumaceous*.]¹

1. *Schœ'nus mucronatus*, Clustered bog-rush, iii. 1, (ap.), 1 f., A.-My., S. Europe. 2. *Scir'pus lacustris*, Tall club-rush, iii. 1, (ap.), 6 f., JI.-Au., Britain. 3. *Scir'pus triquet'-'ter*, Triangular club-rush, iii. 1, (ap.), 3 f., Au., Eng. 4. *Cype'rus vege'tus*, Smooth marsh-sedge, iii. 1, (ap.), 18 in., My.-Au., N. Am. 5. *Phle'um prat'en'se*, Timothy grass, with portions of the flower magnified, iii. 2, (ap.), 2 f., JI., N. Am. 6. *Tric'us'pis quinque'-'fida*, English red-top, iii. 2, (ap.), 2 f., Jn.-Jl., N. Am. 7. *Po'a aquat'ica*, Water meadow-grass, iii. 2, (ap.), 6 f., JI., N. Am. and Britain. 8. *Agros'tis vulga'ris*, American red-top, with the flower magnified, iii. 2, (ap.), 18 in., Jn., N. Am. 9. *Bri'za me'dia*, Common quaking-grass, iii. 2, (ap.), 18 in., Jn., Britain.

into a perfect sheath. The plants of this family are of little value as nutriment to man or beast; but they are found in all parts of the world, in marshes, ditches, running streams, in meadows and on heaths, in groves and forests, on the flowing sands of the sea-shore, on the tops of mountains, from the arctic to the antarctic circle, wherever flowering vegetation can exist.

2. That the *Grasses* occupy a very different position in the vegetable kingdom will at once be apparent when we remark that in this family are found such plants as rye, oats, barley, maize or Indian corn, rice, sugar-cane, bamboo, and reeds, as well as the ordinary grasses. Of about four thousand species, of which this numerous and valuable family consists, only a single one, the poisonous darnel, is known to be injurious to man. All the grasses are provided with true flowers, that is, with stamens and pistils, but there is little trace of the calyx and corolla. The general appearance of the common grasses is so well-known that we need not describe it; nor need we speak of their wide distribution, for every body knows

that they "come creeping, creeping every where," as is prettily told in

THE VOICE OF THE GRASS.

3. Here I come creeping, creeping every where;
You can not see me coming,
Nor hear my low, sweet humming;
For in the starry night,
And the glad morning light,
I come quietly creeping every where.
4. Here I come creeping, creeping every where;
More welcome than the flowers
In summer's pleasant hours;
The gentle cow is glad,
And the merry bird not sad,
To see me creeping every where.
5. Here I come creeping, creeping every where;
When you're number'd with the dead
In your still and narrow bed,
In the happy spring I'll come
And deck your silent home—
Creeping silently, creeping every where.
6. Here I come creeping, creeping every where;
My humble song of praise
Most joyfully I raise
To Him at whose command
I beautify the land,
Creeping, silently creeping every where.—SARAH ROBERTS.

7. Of the immense value of the cereals to mankind we need not attempt to form an estimate; for how could human life, in one half of the globe, be sustained without them? And as to the grasses proper, they are the principal food of the most valuable of the domestic animals. In the United States alone, the value of agricultural products belonging to this great family is estimated at not less than seven hundred millions of dollars annually! And what an amount of labor is bestowed upon their cultivation! What variety and extent of interests are dependent upon the seasonable rain, and the dew, and the sunshine, which our heavenly Father sends to bring them to perfection! And what anxieties are felt about those scourges from insects, and storms, and blight, and mildew, that occasionally injure, and threaten to destroy them!

8. Wheat, "golden wheat," of which there are reckoned three hundred varieties, is supposed to have been, once, an unprofitable grass growing wild on the shores of the Mediterranean, and to have become, by cultivation, the most valuable of all vegetable products. It is now difficult to tell what are mere varieties and what are distinct species; certain it is, that though it thrives best when treated as a biennial—sown in autumn and harvested the following summer—yet winter-wheat sown in spring will ripen the same year, though the produce of succeeding generations of spring-sown wheat is found to ripen better; white, red, and beardless wheat change

[CEREALS.—ENDOGENOUS OR MONOCOTYLEDONOUS; *Glumaceous*.]¹

1. *Trit'icum hyber'num*, Winter wheat, iii. 2, (ap.), 4 f., Jn.-Jl., unknown. 2. *Trit'icum compos'itum*, Egyptian wheat, iii. 2, (ap.), 3½ f., Jn.-Jl., Egypt. 3. *Trit'icum spe'lla*, Spelter wheat, iii. 2, (ap.), 3½ f., Jn.-Jl., Egypt. 4. *Seca'le cerea'le*, Common rye, iii. 2, (ap.), 4 f., Jn.-Jl., Crimea. 5. *Sac'charum officina'rum*, Sugar-cane, iii. 2, (ap.), 12 f., Au., India. 6. *Ave'na fa'tua*, Wild oat, iii. 2, (ap.), 4 f., Au., Britain. 7. *Hor'deum vulga're*, Spring barley, iii. 2, (ap.), 3 f., Jl., Sicily. 8. *Mil'ium effu'sum*, Common millet, iii. 2, (ap.), 4 f., Jn.-Jl., Britain. 9. *Trit'icum Polon'icum*, Polish wheat, iii. 2, (ap.), 4 f., Jn.-Jl., Egypt.

and run into each other on different soils and in different climates; and even the Egyptian wheat is known to change to the single-spiked common plant.

9. The American reader will recollect that in Europe wheat is called corn, a term which we apply only to *maize* or Indian corn. The latter was found cultivated for food by the Indians of both North and South America on the first discovery of the continent, and from this circumstance it derived its popular name. It is still found growing, in a wild state, in the humid forests of Paraguay, where, instead of having each grain naked as is always the case after long cultivation, each is completely covered with glumes or husks. The varieties produced by cultivation are numerous.

10. Indian corn furnishes a fine example of those plants which have staminate flowers on one part of the plant and pistillate on another. Thus the staminate flowers of the corn are those loose yellow branches which grow at the top of the stalk, while the pistillate, hidden among the lower leaves, are

only discovered by their long shining styles which hang from the ears in tufts like silken tassels. One peculiarity noticed in nearly all the members of the Grass family is the exceeding hardness of the outer covering of their stems, which is caused by a thin coating of flinty or silicious matter. The sharp edge of a blade of grass has often cut the flesh of curious or careless boys in the experiment of drawing it through their fingers.

11. Numerous and abundant, throughout all literature, are the tributes of praise with which poetry has striven to enshrine in our affections the valuable cereals we cultivate. The ancients, in their mythology, placed agriculture above all other pursuits, and called CERES, who was the fabled goddess of grain and harvests, the *Great Goddess*, and the *Mighty Mother*. Songs and festivals celebrated her benevolent gifts to man; and when we come down to later ages, we find that songs to the "Harvest Moon," and songs of "Harvest Home," have ever been the most popular of national melodies.

12. Pleasing 'tis, O harvest-moon!
 Now the night is at her noon,
 'Neath thy sway to musing lie,
 While around the zephyrs sigh,
 Fanning soft the sun-tanned wheat,
 Ripened by the summer's heat;
 Picturing all the rustic's joy
 When boundless plenty greets his eye.
 And thinking soon,
 O harvest-moon!
 How many a gladsome eye will roam
 Along the road,
 To see the load,

The last dear load of harvest-home.—HENRY KIRKE WHITE.

As a suitable closing of this lesson we must extend it still farther, and give place to the following, which is both appropriate to the subject, and to be admired for the associations which it recalls.

CORN-FIELDS.

(Corn is a term applied in Europe to all the cereals.)

13. When on the breath of autumn-breeze,
 From pastures dry and brown,
 Goes floating like an idle thought
 The fair white thistle-down,
 Oh then what joy to walk at will
 Upon the golden harvest hill!
14. What joy in dreamy ease to lie
 Amid a field new shorn,
 And see all round, on sunlit slopes,
 The piled-up stacks of corn;
 And send the fancy wandering o'er
 All pleasant harvest-fields of yore.
15. I feel the day—I see the field,
 The quivering of the leaves,
 And good old Jacob and his house
 Blinding the yellow sheaves;
 And at this very hour I seem
 To be with Joseph in his dream.

16. I see the fields of Bethlehem,
And reapers many a one,
Bending unto their sickle's stroke—
And Boaz looking on;
And Ruth, the Moabite so fair,
Among the gleaners stooping there.
17. The sun-bathed quiet of the hills,
The fields of Galilee,
That eighteen hundred years ago
Were full of corn, I see;
And the dear Savior takes his way
'Mid ripe ears on the Sabbath-day.
18. Oh golden fields of bending corn,
How beautiful they seem!
The reaper-folk, the piled-up sheaves,
To me are like a dream.
The sunshine and the very air
Seem of old time, and take me there.—MARY HOWITT.

¹ GLU-MĀ'-OEUS plants are those which have *glumes*, like the husk or chaff of the grains and grasses.

LESSON XXI.—OF THE HIDDEN USES OF PLANTS.

THERE be in plants

Influences yet unthought, and virtues, and many inventions,
And uses above and around, which man hath not yet regarded.
Not long, to charm away disease, hath the crocus yielded up its bulb,
Nor the willow lent its bark, nor the nightshade its vanquished poison;
Not long hath the twisted leaf, the fragrant gift of China,
Nor that nutritious root, the boon of far Peru,
Nor the many-colored dahlia, nor the gorgeous flaunting cactus,
Nor the multitude of fruits and flowers ministered to life and luxury:
Even so, there be virtues yet unknown in the wasted foliage of the elm,
In the sun-dried harebell of the downs, and the hyacinth drinking in the meadow,
In the sycamore's winged fruit, and the facet-cut cones of the cedar;
And the pansy and bright geranium live not alone for beauty,
Nor the waxen flower of the arbut, though it dieth in a day,
Nor the sculptured crest of the fir, unseen but by the stars;
And the meanest weed of the garden serveth unto many uses,
The salt tamarisk, and juicy flag, the freckled orchis, and the daisy.
The world may laugh at famine when forest trees yield bread,
When acorns give out fragrant drink, and the sap of the linden is as fatness:
For every green herb, from the lotus to the darnel,
Is rich with delicate aids to help incurious man.—M. F. TUPPER.

There is perhaps no pursuit which leads the mind more directly to an appreciation of that wisdom and goodness which pervade creation, than the study of the vegetable kingdom, in which infinite variety, beauty, and elegance, singularity of structure, the nicest adaptations, and the most pre-eminent utility, meet us at every step, and compel us to observe and learn, even when often the least disposed to inquiry or reflection.—CHAMBERS.

THIRD DIVISION. CRYPTOGAMOUS PLANTS.

[Cryp-tóg'-a-mous, or Flowerless Plants, are divided into two classes, *Ac'-ro-gens* and *Thal'-lo-gens*; the leading physiological peculiarities of which are,

1st. The stem of an *Acrogens* grows from the end, but does not increase in diameter. *Acrogens* have breathing pores, or *stomata*, in their skin or covering; their leaves and stem are distinctly separated; they produce no flowers, but multiply by reproductive spheroids or spores, somewhat analogous to seeds, but whose nature is not well known.

2d. *Thallogens* are mere masses of *cells*; they have no *stomata* or breathing pores, foliage, or flowers; and they multiply by the spontaneous formation in their interior, or upon their surface, of reproductive spheroids called spores.]

LES. XXII.—FERNS, LIVERWORTS, AND MOSSES. (ACROGENS.)



1. *Polypo'dium vulga're*, Common polyp'ody, or Wall fern, xxi. 1, brown, 1 f., My.—O.
2. *Struthiopteris Pennsylvanica*, Ostrich fern, xxi. 1, br., 2 f., Au. 3. *Pteris atropurpurea*, Rock brake, xxi. 1, br., 10 in., Au.—S. 4. *Aspid'ium Thelypteris*, Lady fern, xxi. 1, 1 f., br., Jl.—Au. 5. *Marchan'tia polymor'pha*, Variable liverwort, xxi. 6, dark green, 2 in., moist rocks, winter. 6. *Autho'eros puncta'ta*, Dotted liverwort, xxi. 6, spring, dark green, 1½ in., damp places. 7. *Sphagnum obtusifolium*, Peat moss, xxi. 5, y. and g., bogs, 7 in. 8. *Gymnos'tomum viridis'simum*, Green moss, xxi. 5, bright green, trees and rocks, 1 in. 9. *Grim'mia apocar'pa*, Alpine moss, xxi. 5, dark olive, 1½ in., dense tufts on rocks and trees. 10. *Ortho'trichum cris'pum*, Crisp moss, xxi. 5, bright green, 1 in., trees. 11. *Grim'mia pulvina'ta*, Cushion moss, xxi. 5, bright green, 1 in., house-tops. 12. *Bartra'mia Halleria'na*, Mountain moss, xxi. 5, bright green, 6 in., mountains. 13. *Hypnum mura'le*, Wall moss, xxi. 5, light green, 1½ in., walls and stones.

1. WE come now to a very singular division of the vegetable world, embracing a vast multitude of plants which differ from those before described in having no flowers for the production of seed and fruit. They indeed bear no true seeds, but are propagated by innumerable small germs called *spores*,

ready to grow where they find a proper home, which is sometimes a piece of bread, or cheese, or decaying wood. Among these plants the highest in order are the *ferns*, which are more like flowering plants than any other family of the cryptogamia; yet even in them no true flower is ever seen; and what are sometimes called their seeds, and which are so minute as to present to the eye only an impalpable¹ powder, are found gathered in brown spots or lines on the under surface of the *fronds* or leafy portions of the mature plant.

"'Tis there the fern displays its fluted wreath,
Beaded beneath with drops of richest brown."

2. Ferns thrive best in damp places, though they sometimes grow in pastures and on dry hill-sides. Thus it has been said of one of the beautiful plants of this family:

"Where the copsewood is the greenest,
Where the fountain glistens sheenest,²
Where the morning dew lies longest,
There the *Lady Fern* grows strongest."

The ferns growing in the Great Dismal Swamp of Virginia are more than four feet in height; and in tropical countries the tree fern rises to the height of thirty or forty feet. One of the most interesting peculiarities of ferns is the spiral manner in which the leaflets are coiled up before their first appearance, each one being rolled in toward the rib that supports it—a peculiarity which has been very prettily noticed in the following lines:

3. "Have ye ever watched it budding,
With each stem and leaf wrapped small,
Coiled up within each other
Like a round and hairy ball?

4. Have ye watched that ball unfolding
Each closely nestling curl,
And its fair and feathery leaflets
Their spreading forms unfurl?

5. Oh, then most gracefully they wave
In the forest like a sea,
And dear as they are beautiful
Are these *fern* leaves to me."

6. It having been ascertained that ferns were propagated by seeds, although the flower, if there were any, was too minute to be detected even by the most powerful microscope, there was a mystery thrown over the plant, which naturally gave rise to many poetic fancies, one of which was the power of rendering invisible the person who was so fortunate as to possess the seed; and to this fancied property we find an allusion in Shakspeare:

"We have the receipt of *fern-seed*; we walk invisible."

7. Scarcely any flowering plants have been greater favorites

with all classes of persons than ferns; nor is this to be wondered at when we consider both their intrinsic beauty, and their association with all that is wild and romantic in scenery, where mountain and valley, rocks and shaded fountains, combine their fascinating influence upon the imagination. Their embellishment of rugged and wild mountain scenery has been embalmed in the poetry of Scott. He sometimes prefers the Caledonian name of brake or *bracken* to that of *fern*. In picturing to the eye the sudden rise and disappearance of the soldiers of Roderick Dhu, when he gave the signal "whistle shrill, and was answered from the hill," we see heath, broom, and bracken forming the ambuscade.

8. "Instant, through cōpse and heath, arose
 Bonnets, and spears, and bended bows;
 On right, on left, above, below,
 Sprung up, at once, the lurking foe;
 From shingles gray their lances start,
 The *bracken* bush sends forth the dart,
 And every tuft of *broom* gives life
 To plaided warrior armed for strife,
 As if the yawning hill to heaven
 A subterranean host had given."

9. And when, after a suitable pause, the chieftain

"Waved his hand,
 Down sunk the disappearing band;
 Each warrior vanished where he stood,
 In broom or *bracken*, heath or wood;
 It seemed as if their mother earth
 Had swallowed up her warlike birth.
 The wind's last breath had tossed in air
 Pennon, and plaid, and plumage fair—
 The next but swept a lone hill-side,
 Where heath and *fern* were waving wide;
 The sun's last glance was glinted³ back
 From spear and glaive,⁴ from targe⁵ and jack,⁶
 The next, all unreflected, shone
 On *bracken* green and cold gray stone."

10. There is an interesting family of plants, called *Liverworts*, belonging to the same class as the ferns, and in many respects resembling the mosses. Their leafy expansions are soft and green; they are usually found growing on moist surfaces, often where there is little or no soil, and are very common in the chinks between paving-stones in unfrequented places, and on the surface of the earth contained in garden-pots, as also upon walls which from any cause are kept constantly damp. Besides the seeds which grow on the leaf, as in ferns, some of the liverworts have little stalks growing from them, and bearing on their summit flower-like appendages which contain minute bodies that seem to have the power of spontaneously detaching themselves from their birthplace. When thrown into the water they move about rapidly like animalculæ.

11. But *mosses* are perhaps the most interesting of this first division of the Cryptogamia; and to them we proceed in the next Lesson.

¹ IM-PĀL'-PA-BLE, that can not be felt; not coarse.

² SHĒEN'-EST, brightest (*obsolete*).

³ GLINT'-ED, glanced; reflected.

⁴ GLĀIVE, a broadsword.

⁵ TĀBĒE, a tār'-get or shield.

⁶ JĀCK, a coat of mail.

LESSON XXIII.—THE MOSSES. (ACROGENS.)

[NOTE.—The following lines apply, perhaps, more appropriately to the *Lichens* than to the *Mosses*. (See Lesson XXV.) But lichens are in common language called mosses.]

1. THE lovely moss! on the lowly cot
It lies like an emerald crown,
And the summer shower pierceth it not,
As it comes rushing down;
And I love its freshened brilliancy,
When the last rain hath pattered,
And the sparkling drops on its surface lie,
Like stars from the pure sky scattered.
2. And I love, I love to see it much,
When on the ruin gray,
That crumbles with Time's heavy touch,
It spreads its mantle gay;
While the cold ivy only gives,
As it shivereth, thoughts of fear,
The closely clinging moss still lives,
Like a friend, forever near.
3. But oh! I love the bright moss most
When I see it thickly spread
On the sculptured stone, that fain would boast
Of its forgotten dead.
For I think if that lowly thing can efface
The fame that earth hath given,
Who is there that would ever chase
Glory, save that of Heaven?—MISS M. A. BROWNE.

4. Mosses are interesting little evergreens, with distinct leaves, and frequently a distinct stem. They do not, like ferns, bear their fructification upon the leaves, but in a little case or urn that is borne on a long distinct stalk. The pulpy matter that is contained in this case becomes dry in ripening, and when arrived at maturity it flies off in the form of an extremely subtile powder, which serves for the propagation of the plant.

5. Mosses are fond of moisture, shade, and retirement; enlivening the dark recesses of solitude by the vivid green of their diminutive foliage; and it is with "mossy fountains," especially, that we have been taught to associate ideas of "cool refreshment," and the quiet of nature in repose.

While we view,
Amid the noontide walk, a limpid rill
Gush through the trickling herbage, to the thirst
Of summer yielding the delicious draught
Of cool refreshment, o'er the mossy bank
Shines not the surface clearer? and the waves
With sweeter music murmur as they flow?—AKENSIDE.

6. Mosses are found in the hottest as well as the coldest climates, growing alike amid torrid sands and arctic snows; and when a coral island springs up above the crested wave, the green moss first crowns its barren summit, and prepares the living rock for the growth of higher forms of vegetation. It was by the contemplation of a delicate moss plant that the heart of Mungo Park, the African traveler, was revived, when the difficulties by which he was surrounded had almost extinguished hope within him. The passage has been often quoted, but, it may be hoped, never without its use, and it does not seem superfluous to introduce it here.

7. This enterprising traveler, during one of his journeys into the interior of Africa, was cruelly stripped and robbed of all that he possessed by banditti. "In this forlorn and almost helpless condition," he says, "when the robbers had left me, I sat for some time looking around me with amazement and terror. Whichever way I turned, nothing appeared but danger and difficulty. I found myself in the midst of a vast wilderness, in the depth of the rainy season—naked and alone—surrounded by savage animals, and by men still more savage. I was five hundred miles from any European settlement. All these circumstances crowded at once upon my recollection, and I confess that my spirits began to fail me. I considered my fate as certain, and that I had no alternative but to lie down and perish.

8. "The influence of religion, however, aided and supported me. I reflected that no human prudence or foresight could possibly have averted my present sufferings. I was indeed a stranger in a strange land, yet I was still under the protecting eye of that Providence who has condescended to call himself the stranger's friend. At this moment, painful as my reflections were, the extraordinary beauty of a small moss irresistibly caught my eye; and though the whole plant was not larger than the top of one of my fingers, I could not contemplate the delicate conformation of its roots, leaves, and fruit without admiration. Can that Being (thought I) who planted, watered, and brought to perfection, in this obscure part of the world, a thing which appears of so small importance, look with unconcern upon the situation and suffering of creatures formed after his own image? Surely not. Reflections like these would not allow me to despair. I started up, and, disregarding both hunger and fatigue, traveled forward, assured that relief was at hand; and I was not disappointed."

9. A distinguished French writer, Rousseau, was particularly fond of mosses. He would often say that they gave an air of youth and freshness to our fields, adorning nature when flowers had vanished. The moss is a useful plant also. The Laplanders protect their humble dwellings with moss, and line the cradles of their little ones with it. May not this explain why a tuft of moss is an emblem of maternal love? Little birds also select the delicate moss for their nests, and squirrels convey it to their winter abodes.

10. "Within a thick and spreading hawthorn bush,
That overhangs a molehill large and round,
I heard, from morn to morn, a merry thrush
Sing hymns to sunrise, and I drank the sound
With joy; and, often an intruding guest,
I watched her secret toils from day to day—
How true she warped the *moss* to form a nest,
And modeled it within with wood and clay."

11. And now, having described the ferns and the mosses, and illustrated them with drawings, we will conclude the first division of the Flowerless Plants with the following beautiful lines by Eliza Cook, which show very forcibly the wisdom of God in creating different species of plants, as well as in permitting the various degrees of what men call prosperity to different classes in society.

LESSON XXIV.—THE FERN AND THE MOSS.

1. THERE was a fern on the mountain, and moss on the moor;
And the ferns were the rich, and the mosses the poor.
And the glad breeze blew gayly; from Heaven it came,
And the fragrance it shed over each was the same;
And the warm sun shone brightly, and gilded the fern,
And smiled on the lowly-born moss in its turn;
And the cool dews of night on the mountain fern fell,
And they glistened upon the green mosses as well.
And the fern loved the mountain, the moss loved the moor,
For the ferns were the rich, and the mosses the poor.
2. But the keen blast blew bleakly, the sun waxed high,
And the ferns they were broken, and withered, and dry;
And the moss on the moorland grew faded and pale,
And the fern and the moss shrank alike from the gale.
So the fern on the mountain, the moss on the moor,
Were withered and black where they flourished before.
3. Then the fern and the moss they grew wiser in grief,
And each turned to the other for rest and relief;
And they planned that wherever the fern-roots should grow,
There surely the moss should be sparkling below.
4. And the keen blasts blew bleakly, the sun waxed fierce;
But no wind and no sun to their cool roots could pierce:

For the fern threw her shadow the green moss upon,
Where the dew ever sparkled undried by the sun ;
When the graceful fern trembled before the keen blast,
The moss guarded her roots till the storm-wind had passed ;
So no longer the wind parched the roots of the one,
And the other was safe from the rays of the sun.

5. And thus, and forever, where'er the ferns grow,
There surely the mosses lie sparkling below ;
And thus they both flourish, where naught grew before,
And they both deck the woodland, and mountain, and moor.

ELIZA COOK.

LESSON XXV.—LICHENS. (THALLOGENS.)



1. *Cenomyce sporas'sa*, Ventricose lichen, xxi. 8, woods, 2 in. 2. *Cenomyce delicta*, Delicate lichen, mealy patch, xxi. 8, on rotten rails, $\frac{1}{2}$ in. (a. enlarged). 3. *Cenomyce rangiferi'na*, Reindeer lichen, xxi. 8, woods, 2 in. 4. *Licida lu'rida*, Lurid lichen, xxi. 8, rocky highlands, 3 in. (b. enlarged). 5. *Cal'cium chrysoceph'alum*, Yellow-head lichen, xxi. 8, lem. col., 3 in. (c. enlarged). 6. *Lecano'ra ocula'ta*, Mottled lichen, xxi. 8, rocks and earth, w., 2 in. (d. enlarged). 7. *Cal'cium capitella'tum*, Sulphur lichen, xxi. 8, gr. and y., $\frac{1}{2}$ in., sandy soil (e. enlarged). 8. *Rocel'la tincto'ria*, Dyer's lichen (yields a fine purple color), xxi. 8, y. and br., $1\frac{1}{2}$ in. 9. *Cetra'ria Islan'dica*, Iceland moss (used in medicine), xxi. 8, ol. br., 2 in.

1. At the head of the second division of the cryptogamia are the *Lichens*,¹ a race of tiny² plants, very common, and yet but little known to the world, though possessed of a beauty by no means inferior to that of gorgeous flowers or lofty trees. Man is but too apt to admire the boundless wealth and beauty

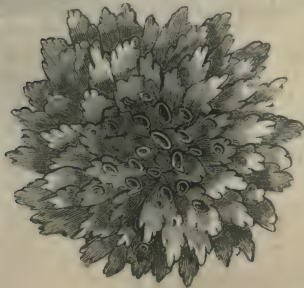
of our great mother, Nature, only where gigantic proportions arrest his attention, or when the storm of enraged elements makes him aware of his own insignificance.

2. Surely his head was not set on high that he might despise low things! But, to see the beauties with which every corner and crevice is decked, to read the lessons conveyed in Nature's subtlest works, something more than the eye is required. We must be willing and able to listen to every beetle's lowly hum, to greet every flower by the wayside as it looks up to us and to heaven, and to question every stone, every pebble. If we thus look upon the tiny lichens around us, we may here also soon learn that, even in the smallest proportions,

"Not a beauty blows,
And not an opening blossom breathes in vain."

3. Lichens, of which more than two thousand species have been described by botanists, assume a great variety of forms, and vary from a mere speck and shriveled leaf to a branching leafless plant a foot or more in height. In their most common forms, in which they are generally known as rock moss or tree moss, they are fleshy or leather-like substances growing on rocks, trees, and old buildings, forming broad patches of various colors, some being of a bluish gray, and others of the richest golden yellow; some spread upon the ground—and these have usually a much larger growth; some, again, hang from the branches of venerable trees, which they clothe with a shaggy beard of gray; and others shoot up from the barren heath, gray and deformed, but eventually fashioning themselves into tiny goblets, the borders of which are studded with crimson shields.

4. Perhaps the most beautiful of all, as well as the most common, are the wall lichens, some of which spread out like wrinkled leaflets, while other varieties assume a beautiful circular form, resembling in outline and shape the fairest rose; and of these it has been said, with quaint but truthful words,



"Careless of thy neighborhood,
Thou dost show thy pleasant face
On the moor and in the wood,
In the lane—there is no place,
Howsoever mean it be,
But 'tis good enough for thee."

And, in reality, there are but few surfaces long exposed to wind

and weather which are not soon protected by the warm cover of these lichens. Our roofs and our fences, the trunk of a tree, and the rock in the moors, the earth-capped dike, and the sterile sea-bank—in fact, all places but sparingly supplied with moisture, but freely exposed to air and light, are clad in ever-varying colors by these beautiful children of Nature. The far-famed Cathedral of Munster may be truly said to be gilded by these tiny lichens.

5. Hardy plants and long-lived are they. Many of them love to live upon a soil little adapted to retain moisture; and of these it has been said that, "Like the lazaroni³ of Naples, they will not work even to live. Carelessly and listlessly they lie in the bright sunshine, and implore with Stoic patience, by their miserable appearance, the pity of passing clouds. In these times of want and drought⁴ they shrink and shrivel until nothing seems farther from them than life. Pale and rigid, they are the very images of desolation, and crumble under the hand into impalpable dust. Yet no sooner has an early dew or a soft rain—nay, even a faint mist—merely touched their unsightly forms, than they begin drinking in moisture with amusing avidity, and, lo and behold, ere many minutes are passed, they expand and increase, until, as if touched by a magic wand, they have recovered their fresh, joyful color and youthful vigor."

6. In extent of geographical distribution they exceed even the mosses; and they are met with, in one place or other, from the equator to the poles, and from the sea-shore to the summits of lofty mountains. Humboldt discovered a species of this plant at a height of more than eighteen thousand feet, "the last child of the vegetable kingdom at that unsurpassed elevation, close to the top of Chimborazo;" and large numbers of small but vigorous lichens are known to spread over the Alps, even close to the eternal snows of Mount Blanc.

Rocks sublime
To human art a sportive semblance bore,
And yellow lichens covered all the clime,
Like moonlit battlements, and towers decayed by time.—CAMPBELL.

7. Another writer has beautifully described these hardy plants as crowning the heights of Snowdon, above the region of clouds and storms.

Where frowning Snowdon bends his dizzy brow
O'er Conway, listening to the surge below,
Retiring *Lichen* climbs the topmost stone,
And drinks the aerial solitude alone:
Bright shine the stars, unnumbered, o'er her head,
And the cold moonbeam gilds her flinty bed;

While round the rifted rocks hoarse whirlwinds breathe,
And dark with thunder sail the clouds beneath.—DARWIN.

8. But lichens are far from being idle intruders upon the domains of solitude, or mere ornaments woven into the bright carpet that covers our earth. From them many articles of food, even for man, and bright dyes, are obtained: the Iceland moss, a species of lichen, is now much used in medicine, especially in pulmonary affections; humbler animals subsist upon these plants; and the well-known reindeer moss sustains for months the life of a whole race of noble animals, without whom a large portion of our globe would be but a desert, unfit for the abode of man. This may here be referred to as one of the many examples that might be cited of that beautiful adaptation which prevails throughout all animated nature.

9.

Reindeer! not in fields like ours,
Full of grass and bright with flowers,
Hast thou dwelling'; nor dost thou
Feed upon the orange-bough'.
When thou wast at first designed
By the great Creative mind',
Thou for frozen lands wast meant',
Ere the winter's frost was sent';
And in love He sent thee forth
To thy home, the frozen north,
Where he bade the rocks produce
Bitter lichens for thy use.—MARY HOWITT.

10. All lichens are amply endowed with starch; and with this not only most of the cells are filled, but even the walls themselves are mainly composed of it. A leathern-like lichen grows largely in the limestone mountains of Northern Asia, and serves, in times of famine at least, as food for the roving Tartars. In the polar regions of Europe similar lichens are carefully soaked and boiled down to free them of their original bitterness, and then cooked with milk, or baked into bread. Scanty lichens of this kind, which had to be dug out from under sheltering loads of snow, were, not for days, but for whole months, the sole food of the unfortunate navigator Franklin and his companions.

¹ LĪ'-CHEN (usually pronounced lī'-kēn).

² TĪ'-NY or TĪN'-Y.

³ LAZ-A-BŪ'-NL, a class of beggars and idlers.

⁴ DROUGHT (drowt), the same meaning as drouth.

LES. XXVI.—FUNGI, OR FUNGIOUS PLANTS. (THALLOGENS.)



1. *Agaricus procerus*, Giant ag'aric, xxi. 9, w. and br., 6 in., gardens. 2. *Agaricus pruinulus*, French mushroom, xxi. 9, white, 1½ in., woods. 3. *Agaricus bulbosus*, Radish-scented mushroom, xxi. 9, br., 4 in., among grass. 4. *Agaricus squarro'sus*, Squarrose ag'aric, xxi. 9, rusty-iron color, 2 in., roots of trees. 5. *Agaricus flav'idus*, Yellow ag'aric (eatable), xxi. 9, pale yellow, 2 in., trunks of trees. 6. *Agaricus te'ner*, Brittle gal'era, xxi. 9, y. and br., 4 in., grassy places. 7. *Agaricus campe'stris*, Common mushroom, xxi. 9, whitish, pink below, 3 in., cultivated in gardens. 8. *Polypo'rus gigante'us*, Beech-tree toadstool, xxi. 9, pale brown, 20 in., on beech-trees. 9. *Tru'ber cibari'um*, Common truffle, xxi. 9, brown, 1½ in., under ground. 10. *Phal'lus can'tinus*, Scentless morel, xxi. 9, pk, 4 in. 11. *Asco'phora muc'e'do*, a common mould, xxi. 9, ½ in.

1. UNDER the name *Fungi*¹ botanists comprehend not only the various races of mushrooms, toad-stools, and similar productions, but a large number of microscopic plants forming the appearances called mouldiness, mildew, smut, rust on the straw of grains, dry rot in wood, and blight in corn. Many of them are mischievous parasitical² plants, found wherever there is decaying vegetation; and they sometimes grow upon animals, and even upon the hand and in the lungs of man.

2. They often spring up and develop with remarkable rapidity; and it has been said that fungous¹ vegetation has been found on iron which but a few hours before had been red hot in the forge. Their mode of fructification is doubtless similar to that already described for ferns and other cryptogamia, except that the whole plant is a mass of reproductive matter; and so minute are the germs or seeds of parasitic fungi as to

defy the power of the microscope; and hence it is thought that they circulate in the sap of vegetables and in the blood of animals. When dried masses of them are set free they resemble thin smoke, as in the powder of puff-balls; and so light are they that it is difficult to conceive a place from which they can be excluded.

3. The variety of forms and tints of this curious family of plants is most numerous. Some of them, called the *bolēti*, exhibit, when broken, a remarkable change of color, the white or yellowish tint becoming instantly of a vivid blue. Some are nearly fluid, while others are like paper, leather, or cork. There is a kind which vegetates in dark mines far from the light of day, and which is remarkable for its phosphorescent properties. In the coal-mines near Dresden these plants are described as giving those places the air of an enchanted castle: the roof, walls, and pillars are entirely covered with them, and their beautiful light is almost dazzling to the eye.

4. In size, too, the fungi vary from minute specks to masses several feet in circumference. The most wonderful thing about mushrooms is the rapidity of their growth and of their propagation. Puff-balls have grown six inches in diameter in a single night. Notwithstanding the soft and cellular structure of the plant, they have grown in glass vessels until they have broken them; and even heavy stones have been raised by numerous fungi growing under them.

5. Unlike other plants, *fungi* absorb oxygen from the air, and exhale carbonic acid. Many mushrooms are very poisonous, while others are esteemed valuable as articles of food. A curious fungous plant, called the *truffle*, grows entirely under ground. It is highly esteemed in Europe as an article of food, but it has never been successfully cultivated. It grows in Virginia and North Carolina, where it is known as Indian bread or Indian loaf, but more generally by the name of *Tuckahoe*. Tuckahoe, when fresh, has an acrid taste, but becomes edible³ when dry. Tinder or *spunk* is a kind of mushroom of the genus *Agaric*.⁴ Various kinds of fungi, besides our common puff-ball, have been used to stop bleeding, and also for many medicinal purposes. The poet Delille has told us in verse of

"The potent *agaric*,⁴ to wounds applied,
That stops the gushing of the sanguine tide;
Whose spongy substance to its bosom takes
The crackling spark, as from the flint it breaks."

6. A fungus of remarkable intoxicating properties, similar in appearance to our mushroom, grows in Siberia. After eat-

ing freely of it, cheerfulness is first produced, then the face becomes flushed, and giddiness and drunkenness follow in the same way as from the use of alcoholic drinks. In some it provokes to unusual activity, and stimulates to bodily exertion. When taken in large doses it produces violent spasms. So very exciting to the nervous system in many individuals is this fungus, that the effects are often very ludicrous. A talkative person can not keep silence, and one fond of music is perpetually singing; and if a person under its influence wishes to step over a straw, he will make a jump sufficient to clear the trunk of a tree.

“O that men should put an enemy in their mouths to steal away their brains.”

¹ FŪN'-ēī, the plural of Fŭn'-gus (fŭng'-gus). ³ ĒN'-i-BLE, eatable; good for food.

² PAR-A-SĪT'-IC-AL, pertaining to a plant that grows and lives on another. ⁴ AG'-A-RIC, a genus of fungi.

LESSON XXVII.—ALGÆ, OR SEA-WEEDS. (THALLOGENS.)



1. *Fucus natans*, or vesiculosus, Bladdery fucus, xxi. 7, ol. gr., 24 f., floating masses, ocean. 2. *Fucus canaliculatus*, Channeled fucus, xxi. 7, y. and ol., 6 f., ocean. (The ashes of the fucus produce the kelp or potash of commerce.) 3. *Sporochinus pedunculatus*, xxi. 7, lt. gr., 6 f.: a portion magnified. 4. *Chondria pinnatifida*, Pepper dulse (this is eaten in Scotland), xxi. 7, purplish, 6 f. 5. *Laminaria esculenta*, Sea tangle (eatable), xxi. 7, br., 60 f. 6. *Conferva glomerata*, Clustered conferva, xxi. 7, lt. gr., 1 f.: a filament magnified. 7. *Cladostephus spongiosus*, Spongy conferva, xxi. 7, gr., 3 f.: a portion magnified. 8. *Alcyonium diaphanum* (a fleshy mass), xxi. 7, y., 6 f. 9. *Echinella articulata*, Floating film: magnified. The small stars show the natural size: gr.

How various the shades of marine vegetation,
Thrown here the rough flints and sea-pebbles among!
The feathered conferva of deepest carnation,
The dark purple sloke, and the olive sea-thong.—CHARLOTTE SMITH.

1. Under the division of *Algæ*,¹ or *Sea-weeds*, botanists have included a great number of flowerless plants, inhabiting both salt and fresh water, but chiefly the former. Though simple in structure, and but little known to the world generally, they number several thousand species, and embrace a great variety in size, form, and extent of development, from mere microscopic cells floating on the surface of water, to vast submarine forests of the most luxuriant vegetation. In their lowest forms some of these cellular plants approach so nearly the boundary between vegetable and animal life, that it is impossible to tell where the one ends and the other begins.

2. Most persons have doubtless noticed a green mucous² substance that collects on the surface of stones constantly moistened by water. This constitutes some of the lowest forms of algal vegetation, consisting of little more than minute vegetable cells. Such sometimes spread over the ocean for miles in extent, giving to it their own peculiar color. The Red Sea has derived its name from a minute fungous plant which sometimes covers its waters, as with a thin layer of fine red dust, as far as the eye can reach.

3. But go to the North Sea, and a great advance in this kind of vegetable structure may be found. There may be seen a thread-like species³ of sea-weed, thirty or forty feet in length, not larger than a pipe-stem, attached at one end to the bottom or shore, and the rest supported by the water; and in the neighborhood of the Orkneys it forms meadows through which a boat forces its way with difficulty. But even this is nothing as compared with the prodigious extent of another thread-like species,⁴ which is reported to be more than a thousand feet in length; while still another kind, in tropical seas, attains a length of twenty-five or thirty feet, with a trunk thicker than a man's arm.

4. Although most sea-weeds attach themselves to rocks or other solid masses, frequenting the shores or shallows rather than the open sea, there are some exceptions, among which one of the most remarkable is the *Sargasso* or *Gulf Weed*, which floats on the surface of the ocean. "Midway in the Atlantic Ocean," says Commander Maury, "is the Sargasso Sea, covering an area equal in extent to the Mississippi Valley, and so thickly matted over with Gulf weed that the speed of vessels passing through it is much retarded. When the

companions of Columbus saw it, they thought it marked the limits of navigation, and became alarmed. To the eye at a little distance it seems substantial enough to walk upon. Columbus first found this weedy sea in his voyage of discovery; and it has remained to this day, moving up and down, and changing its position according to the seasons, the storms, and the winds."

5. But, in addition to this "weedy sea," the ocean every where bears on its bosom sea-weeds torn from the rocks by the ever "toiling surges," and driven hither and thither by the winds and waves. Yet even these, although among the lowest forms of vegetable life, have not been found an unfitting theme for the poet, as the following lines will show:

6. When descends on the Atlantic
 The gigantic
 Storm-wind of the equinox,
 Landward in his wrath he scourges
 The toiling surges,
 Laden with sea-weed from the rocks;
7. From Bermuda's reefs; from edges
 Of sunken ledges
 Of some far off, bright Azôre;
 From Bahama, and the dashing,
 Silver-flashing
 Surges of San Salvador;
8. Ever drifting, drifting, drifting,
 On the shifting
 Currents of the restless main,
 Till in sheltered coves, and reaches
 Of sandy beaches,
 All have found repose again.
9. So when storms of wild emotion
 Strike the ocean
 Of the poet's soul, ere long,
 From each cave and rocky fastness,
 In its vastness,
 Floats some fragment of a song;
10. Ever drifting, drifting, drifting,
 On the shifting
 Currents of the restless heart,
 Till at length, in books recorded,
 They, like hoarded
 Household words, no more depart.—LONGFELLOW.

11. Of all tribes of plants the Algæ are commonly reputed the least useful. Yet neither in regard to the general economy of nature, nor as to the wants of man, are they to be so considered. They supply food to a large number of marine animals, which browse upon them as those inhabiting the land do upon its most luxuriant pastures. Cattle have been very profitably fed on some species abundant on northern coasts, and have even become so fond of this diet as greedily to seek for it. Many kinds furnish a wholesome and palatable food for man, and are used for this purpose by the poorer classes.

along the shores of the North of Europe, while others are reckoned a luxury by the rich. The ashes of sea-weeds have been in great demand for the soda they contain, which is used in the manufacture of hard soap. Iodine, so useful as a medicine, being the only known cure for scrofula, and indispensable in taking daguerreotype or photographic pictures, is found in the kind called *fucus*,⁵ or *sea-wort*.

12. The sea-wort floating on the waves, or rolled up high along the shore,
 Ye counted useless and vile, heaping on it names of contempt :
 Yet hath it gloriously triumphed, and man been humbled in his ignorance,
 For health is in the freshness of its savor, and it cumbereth the beach with wealth ;
 Comforting the tossings of pain with its violet-tinctured essence,
 And by its humbler ashes enriching many proud.
 And herein, as thou walkest by the sea, shall weeds be a type and an earnest
 Of the stored and uncounted riches lying hid in all creatures of God.

MARTIN FARQUHAR TUPPER.

13. Algæ are mostly of an olive-green, gray, or red color ; and their little capsules or air-chambers often have the appearance of berries. Corals are sometimes found attached to them. It is an easy task for those who live near the sea-shore, especially in the New England States, to make beautiful collections of these "flowers of the ocean." Although they at first appear like little uninviting bits of red scum, they may often be spread out, by floating them in a basin of water, so as to show the expansion of the plant. A piece of paper may then be inserted under them, and when the plants have been carefully lifted up by it, dried, and pressed, they will present something like the annexed representation. These are accurate copies, of full size, of specimens of a beautiful red color, which were obtained at Nahant, near Boston.



2. *Delesse'ria plocam'num*.

1. *Delesse'ria sanguin'ea*.

14. A weary weed, tossed to and fro,
 Drearily drenched in the ocean brine,
 Soaring high and sinking low,
 Lashed along without will of mine ;
 Sport of the spoom⁶ of the surging sea,
 Flung on the foam afar and near,
 Mark my manifold mystery,
 Growth and grace in their place appear.

15. I bear round berries, gray and red,
 Rootless and rover though I be,
 My spangled leaves, when nicely spread,
 Arborese as a trunkless tree ;
 Corals curious coat me o'er,
 White and hard in apt array ;
 Mid the wild waves' rude uproar,
 Gracefully grow I night and day.

C. G. FENNER.

¹ ÄL'-GA, a sea-weed ; plural ÄL'-gæ.

² MÛ'-cous, slimy ; viscous.

³ The *Chorda filum*.

⁴ The *Macrocytis pyrifera*.

⁵ This is the *Fucus natans*.

⁶ SPÖÖM, foam ; probably from *spume*,



1. *Cy'cas revolu'ta*, a Cycad, a plant intermediate in form between palms and ferns: it is cultivated in the E. Indies for its fruit, and also for the *sago* which is obtained from the pith. 2. *Aphelan'dra cristu'ta*, an Acanthad. 3. *Ech'mea ful'gens*, a plant of the same family as the Pine-apple. 4. *Litt'e'a geminiflo'ra*, or *Buonapar'tea jun'cea*, an Amaryllid. 5. *Loa'sa pentland'ica*, a handsome annual, with yellow flowers.

1. By domestic flower-culture we mean the endeavor to grow rare and ornamental varieties of flowering and other plants in every available situation connected with our dwellings. Be it window-recess, balcony, staircase, porch, or tiny front plot, it matters not, provided there be sufficient exposure to light and sunshine. Some such place is at the disposal of almost every one who enjoys the shelter of a roof, whether he is an inhabitant of the open country or the crowded city, the tenant of a single apartment, or the proprietor of a lordly mansion. The culture thus alluded to forms one of the most delightful recreations in which the enlightened mind can engage; it is innocent and cheerful; can be cheaply obtained; and, like other rational pastimes, may lead to pursuits of a more profitable nature.

2. The beauty and variety of flowers, the fragrance and freshness which we are insensibly led to associate with them, have long been themes for the poet and naturalist, but, really not more so than the subject deserves. The endless forms

in which plants appear, their adaptations to certain situations, the peculiar properties which many species possess, though all grow on the same soil, the wonderful metamorphoses which they undergo from seed to plant, and from plant and flower to seed again, not to speak of the amenity¹ and beauty with which they invest the landscape, or of the utility they confer as articles of food, medicine, and clothing, are all subjects of never-failing interest to a reflective mind.

3. But every one has not the opportunity of enjoying this contemplation in the field; and even if he had, the produce of one climate differs so widely from that of another, that his own district would furnish him with a mere fraction of the numerous vegetable families. Knowledge, however, has overcome this difficulty; for, by the aid of the sheltered garden, the conservatory, and hot-house, the genera of any country can be brought within the compass of a few superficial acres. What can be thus accomplished by the scientific gardener may be imitated on a small scale by domestic culture, and with comparatively less expense, as our apartments yield that shelter and temperature which it costs the gardener so much to obtain.

4. The individual therefore who can rear in his window-recess, in his lobby, or around his porch, the shrubs and flowers of other lands, has always a subject of contemplation before him; something to engage the attention, and to preserve the mind from the listlessness of ennui,² or from positively pernicious pursuits. Any member of a family who has a little stand of plants to water, to clean, and prune, has always a pleasant daily recreation before him; his love and care increase with these objects; the simple duty becomes necessary to his existence, and he has what so many are miserable for the want of, something to occupy hours of listlessness or leisure.³

5. Again, plants are objects of beauty and ornament. Why is yonder lowly cottage more lovely and inviting than the large farm-house on the other side of the river? Simply because its walls are trellised⁴ with the rose and honeysuckle, and its porch with the clambering hop, whose dark green contrasts so finely with the whitewashed front; while the latter is as cold and uninviting as bare stone walls can make it. So it is with any apartment, however humble. The little stand of flowers in the window-recess, with their green leaves and brilliant blossoms, adds a charm and freshness to the place; and we will answer for it, that wherever these are, the furniture, though mean, will be clean and neatly arranged.

6. The individual who prides himself on the favorite plants that blossom on his window-sill, will see that that window be in such order as shall show them off to advantage; and the taste that leads to the establishment of neatness in one corner, will not be long in spreading to the most secret nook of the apartment. Moreover, the individual who cherishes his little array of flowers in his window will often repair to the hills and river sides in search of new favorites; he will insensibly acquire a love for nature, and find his enjoyment in studying her mysteries and admiring her beauties, whether in garden, field, or forest, instead of spending his time in the haunts of idleness and dissipation.

7. The in-door cultivation of plants is also intimately connected with the sanitary⁵ condition of our dwellings. The oxygen of the atmosphere is indispensable to the respiration of animals; it purifies their blood, and affords them internal heat; and, united with certain elements, it is expired in the form of carbonic acid gas, a compound of oxygen and carbon.* This gas, which is deleterious to animal life, constitutes the main nourishment of plants, which absorb it, appropriate its carbon, and restore its oxygen to the atmosphere, again to be breathed in purity by men and animals.^b

8. It is true that pure air is necessary alike to the life of plants and animals; but the amount of oxygen absorbed by the former is by no means equal to that which they restore; and thus, through their agency, the atmosphere is kept in healthy equilibrium. It was long thought that plants absorbed carbonic acid during the day only, and under the influence of light, and that it was given off by them during the night season, thus vitiating the air in apartments in which they were kept; but this is now believed to be an error. It is confidently asserted that carbonic acid is never disengaged by them during the healthy condition of the leaf, and that the fluid which they so abundantly exhale is *pure water*. If this be the case, growing plants can not, under any condition, impair the purity of the atmosphere, but rather the reverse, unless the odor which they emit be too powerful to be agreeable.

CHAMBERS' *Miscellany*.

¹ A-MĒN'-I-TY, pleasantness.

² EN-NŪY' (*ân-we'*, French), languor arising from lack of occupation.

³ LEIS'-URE (*lê'-zhur*), freedom from occupation.

⁴ TRĒL'-LISED, furnished with a trellis or wooden frame.

⁵ SĀN'-I-TA-EY, pertaining to or designed to secure health.

* See Lesson XIII., p. 112; also Fourth Reader, pp. 50, 53-4.

^b See p. 269; also Fourth Reader, p. 211.

FOURTH MISCELLANEOUS DIVISION.



LESSON I.—EVA.

1. A COTTAGE in a peaceful vale ;
A jasmine round the door ;
A hill to shelter from the gale ;
A silver brook before.
2. Oh, sweet the jasmine's buds of snow,
In mornings soft with May ;
Oh, silver-clear the waves that flow,
Reflecting heaven, away !

3. A sweeter bloom to Eva's youth
Rejoicing Nature gave;
And heaven was mirrored in her truth
More clear than on the wave.
 4. Oft to that lone, sequester'd place
My boyish steps would roam;
There was a look in Eva's face
That seem'd a smile of home.
 5. And oft I paused to hear at noon
A voice that sang for glee;
Or mark the white neck glancing down,
The book upon the knee.
 6. Years pass: the same—the peaceful vale,
The jasmine round the door,—
The hill still shelters from the gale,
The brook still glides before:
 7. Still sweet the jasmine's buds of snow;—
But 'neath the yew-tree's shade,
Where silver-clear the waters flow,
Her holy dust is laid.—BULWER LYTTON.
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LESSON II.—GIL BLAS AND THE ARCHBISHOP, OR THE DANGER OF GIVING ADVICE.

Archbishop. WHAT is your business with me', my friend'?

*Gil Blas.*¹ I am the young man who was recommended to you by your nephew, Don Fernando.

Arch. Oh! you are the person of whom he spoke so handsomely. I retain you in my service; I regard you as an acquisition. Your education, it would seem, has not been neglected; you know enough of Greek and Latin for my purpose, and your handwriting suits me. I am obliged to my nephew for sending me so clever a young fellow. So good a copyist must be also a grammarian. Tell me, did you find nothing in the sermon you transcribed for me which shocked your taste? no little negligence of style, or impropriety of diction?

Gil B. Oh, sir! I am not qualified to play the critic; and if I were, I am persuaded that your grace's compositions would defy censure.

Arch. Ahem! well, I do flatter myself that not many flaws could be picked in them. But, my young friend, tell me what passages struck you most forcibly.

Gil B. If, where all was excellent, any passages more particularly moved me, they were those personifying hope, and describing the good man's death.

Arch. You show an accurate taste and delicate appreciation. I see your judgment may be relied upon. Give yourself no inquietude, Gil Blas,¹ in regard to your advancement in life. I will take care of that. I have an affection for you, and, to prove it, I will now make you my confidant. Yes, my young friend, I will make you the depositary of my most secret thoughts. Listen to what I have to say. I am fond of preaching, and my sermons are not without effect upon my hearers. The conversions of which I am the humble instrument ought to content me. But—shall I confess my weakness?—my reputation as a finished orator is what gratifies me most. My productions are celebrated as at once vigorous and elegant. But I would, of all things, avoid the mistake of those authors who do not know when to stop—I would produce nothing beneath my reputation; I would retire seasonably, ere that is impaired. And so, my dear Gil Blas, one thing I exact of your zeal, which is, that when you shall find that my pen begins to flag and to give signs of old age in the owner, you shall not hesitate to apprise me of the fact. Do not be afraid that I shall take it unkindly. I can not trust my own judgment on this point; self-love may mislead me. A disinterested understanding is what I require for my guidance. I make choice of yours, and mean to abide by your decision.

Gil. B. Thank Heaven, sir, the period is likely to be far distant when any such hint shall be needed. Besides, a genius like yours will wear better than that of an inferior man; or, to speak more justly, your faculties are above the encroachments of age. Instead of being weakened, they promise to be invigorated by time.

Arch. No flattery, my friend. I am well aware that I am liable to give way at any time, all at once. At my age, certain infirmities of the flesh are unavoidable, and they must needs affect the mental powers. I repeat it, Gil Blas, so soon as you shall perceive the slightest symptom of deterioration in my writings, give me fair warning. Do not shrink from being perfectly candid and sincere, for I shall receive such a monition as a token of your regard for me.

Gil B. In good faith, sir, I shall endeavor to merit your confidence.

Arch. Nay, your interests are bound up with your obedience in this respect; for if, unfortunately for you, I should hear in the city a whisper of a falling-off in my discourses—an intimation that I ought to stop preaching—I should hold you responsible, and consider myself exempted from all care

for your fortunes. Such will be the result of your false discretion.

Gil B. Indeed, sir, I shall be vigilant to observe your wishes, and to detect any blemish in your writings.

Arch. And now tell me, Gil Blas, what does the world say of my last discourse? Think you it gave general satisfaction?

Gil B. Since you exact it of me in so pressing a manner to be frank—

Arch. Frank? Oh, certainly, by all means; speak out, my young friend.

Gil B. Your grace's sermons never fail to be admired; but—

Arch. But—Well? Do not be afraid to let me know all.

Gil B. If I may venture the observation, it seemed to me that your last discourse did not have that effect upon your audience which your former efforts have had. Perhaps your grace's recent illness—

Arch. What, what! Has it encountered, then, some Aristarchus?

Gil B. No sir, no. Such productions as yours are beyond criticism. Every body was charmed with it; but—since you have demanded it of me to be frank and sincere—I take the liberty to remark that your last discourse did not seem to me altogether equal to your preceding. It lacked the strength—the—Do you not agree with me, sir?

Arch. Mr. Gil Blas, that discourse, then, is not to your taste?

Gil B. I did not say that, sir. I found it excellent—only a little inferior to your others.

Arch. So! Now I understand. I seem to you to be on the wane—eh? Out with it! You think it about time that I should retire?

Gil B. I should not have presumed, sir, to speak so freely, but for your express commands. I have simply rendered you obedience; and I humbly trust that you will not be offended at my hardihood.

Arch. Offended! Oh! not at all, Mr. Gil Blas. I utter no reproaches. I don't take it at all ill that you should speak your sentiments; it is your sentiment only that I find ill. I have been duped in supposing you to be a person of any intelligence—that is all.

Gil B. But, sir, if, in my zeal to serve you, I have erred in—

Arch. Say no more—say no more! You are yet too raw

to discriminate. Know that I never composed a better sermon than that which has had the misfortune to lack your approbation. My faculties, thank Heaven, have lost nothing of their vigor. Hereafter I will make a better choice of an adviser. Go, tell my treasurer to count you out a hundred ducats, and may Heaven conduct you with that sum. Adieu, Mr. Gil Blas. I wish you all manner of prosperity—with a little more taste.—*Dramatized from LE SAGE.*

¹ GIL BLÄS (*French*), pronounced ZHÏL BLÄS, the *g* being sounded like *z* in *azure*. The concluding *s* is sounded. | ² AR-IS-TÄR'-CHUS, a celebrated critic of antiquity, whose criticisms were so severe that his name has become proverbial.

LESSON III.—THE BELLS.

[This is a difficult piece, which professional elocutionists delight to read. The voice should aim to imitate the *tones* of the different bells, and at the same time to call forth the feelings which the different occasions of their use suggest.]

1. HEAR the sledges with the bells'—

a. Silver' bells'—

What a world of merriment their melody foretells'!

How they tinkle, tinkle, tinkle;

In the icy air of night'!

While the stars that oversprinkle

All the heavens', seem to twinkle

With a crystalline delight' ;

Keeping time, time, time,

In a sort of Runic¹ rhyme,

To the tintinnabulation² that so musically wells

From the bells, bells, bells, bells,

Bells, bells, bells—

From the jingling and the tinkling of the bells.

2. Hear the mellow wedding-bells,

b. Golden bells !

What a world of happiness their harmony foretells !

Through the balmy air of night

How they ring out their delight !

From the molten-golden notes,

And all in tune,

What a liquid ditty floats

To the turtle-dove that listens, while she gloats

On the moon !

Oh, from out the sounding cells,

What a gush of euphony³ voluminously wells' !

How it swells' !

How it dwells—

On the Future' ! how it tells

Of the rapture that impels

a. Pronounced in a soft and silvery tone. The remainder of the verse should be read in a sprightly manner—approaching a sing-song tone.

b. Prolonged, smooth, and flowing. The verse should be read in a tone full, smooth, and harmonious—dwelling, with a kind of luxuriant delight, upon the emphatic words.

To the swinging and the ringing
 Of the bells, bells, bells—
 Of the bells, bells, bells, bells,
 Bells, bells, bells—

To the rhyming and the chiming of the bells !

3. Hear the loud alarm bells—

a. Brazen bells !

What a tale of terror, now, their turbulency tells !

In the startled ear of night

How they scream out their affright !

Too much horrified to speak,

They can only shriek, — shriek, —

Out of tune,

In a clamorous appealing to the mercy of the fire,

In a mad expostulation with the deaf and frantic fire

Leaping higher, higher, higher,

With a desperate desire,

And a resolute endeavor,

Now—now to sit or never,

By the side of the pale-faced moon.

Oh, the bells, bells, bells !

What a tale their terror tells

Of despair !

How they clang, and clash, and roar !

What a horror they outpour

On the bosom of the palpitating air !

Yet the ear, it fully knows,

By the twanging

And the clanging,

How the danger ebbs and flows ;

Yet the ear distinctly tells,

In the jangling

And the wrangling,

How the danger sinks and swells,

By the sinking or the swelling in the anger of the bells—

Of the bells—

Of the bells, bells, bells, bells,

Bells, bells, bells—

In the clamor and the clangor of the bells !

4. Hear the tolling of the bells—

b. Iron bells !

What a world of solemn thought their monody^a compels !

In the silence of the night,

How we shiver with affright

At the melancholy menace of their tone !

For every sound that floats

From the rust within their throats

Is a groan.—

And the people—ah, the people—

They that dwell up in the steeple,

a. Harsh and loud—the voice alternately sinking and swelling throughout the verse, as “the danger sinks and swells,” and to accord with “the anger of the bells.”

b. Deep, slow, and solemn.

All alone,—

a. And who tolling,—tolling,—tolling,—

In that muffled monotone,

Feel a glōry in so rolling

On the human heart a stone!—

They are neither man nor woman—

They are neither brute nor human—

They are Ghoul¹:⁵

And their king it is who tolls;

a. And he rōlls,—rōlls,—rōlls,—rōlls,—

A pæan⁶ from the bells!

And his merry bosom swells

With the pæan of the bells!

b. And he dances and he yells;

Keeping time, time, time,

In a sort of Runic rhyme,

To the pæan of the bells—

Of the bells;

Keeping time, time, time,

In a sort of Runic rhyme,

c. To the throbbing of the bells—

Of the bells, bells, bells,

c. To the sobbing of the bells;

Keeping time, time, time,

As he knells, knells, knells,

In a happy Runic rhyme,

d. To the rōlling of the bells—

Of the bells, bells, bells—

d. To the tolling of the bells,

Of the bells, bells, bells, bells—

Bells, bells, bells,

e. To the mōaning and the grōaning of the bells.—EDGAR A. POE.

¹ RŦ'-NĪE, Gothic in character; rude.

² TIN-TIN-NAB-U-LĀ'-TION, a tinkling, as of little bells.

³ EŦ'-PHO-NY, musical sweetness of sound.

⁴ MŦN'-O-DY, a poem or song sung by one person to express his grief.

⁵ GHŦUL, a fabled demon that feeds on human flesh.

⁶ PÆ'-AN, (*pæ'-an*), a joyous or triumphal song.

LESSON IV.—SPEAKING AND DOING.

SPEECH without action is a moral dearth,

And to advance the world is little worth:

Let us think much, say little, and much do,

If to ourselves and God we will be true;

And ask within,

What have I done of that I have to do?

Is conscience silent—say'?

Oh! let my deeds be many and my words be few.—BULLEID.

a. a. Heavy and prolonged monotone.

b. A degree of unearthly wildness is here expressed, indicative of the exultation of the "Ghoul¹!"

c. c. The words *throbbing* and *sobbing* are emphatic.

d. d. *Rolling* and *tolling* require prolonged emphasis.

e. The voice should be much prolonged on *moaning* and *groaning*—the sound harmonizing with the sense.

LESSON V.—RESISTANCE TO BRITISH OPPRESSION.

THE battle, sir, is not to the strong alone ; it is to the active, the vigilant, the brave. Besides, sir, we have no election. If we were base enough to desire it, it is now too late to retire from the contest. There is no retreat but in submission and slavery. Our chains are forged. Their clanking may be heard on the plains of Boston. The war is inevitable, and let it come ! I repeat it, sir, let it come ! It is in vain, sir, to extenuate the matter. Gentlemen may cry Peace ! peace ! but there is no peace. The war is actually begun ! The next gale that sweeps from the north will bring to our ears the clash of resounding arms ! Our brethren are already in the field. Why stand we here idle ? What is it that gentlemen wish ? What would they have ? Is life so dear, or peace so sweet, as to be purchased at the price of chains and slavery ? Forbid it, Heaven ! I know not what course others may take ; but as for me, give me liberty, or give me death !

PATRICK HENRY.

LESSON VI.—THE AMERICAN INDIANS.

As a race, they have withered from the land. Their arrows are broken, their springs are dried up, their cabins are in the dust. Their council-fire has long since gone out on the shore, and their war-cry is fast dying away to the untrodden West. Slowly and sadly they climb the distant mountains, and read their doom in the setting sun. They are shrinking before the mighty tide which is pressing them away ; they must soon hear the roar of the last wave, which will settle over them forever. Ages hence, the inquisitive white man, as he stands by some growing city, will ponder on the structure of their disturbed remains, and wonder to what manner of person they belonged. They will live only in the songs and chronicles of their exterminators. Let these be faithful to their rude virtues as men, and pay due tribute to their unhappy fate as a people.—SPRAGUE.

TIMES of general calamity and confusion have ever been productive of the greatest minds. The purest ore is produced from the hottest furnace, and the brightest thunder-bolt is elicited from the darkest storm.—LACON.

PART V.
FOURTH DIVISION OF ZOOLOGY;¹
EMBRACING
ICHTHYOLOGY,²
OR THE NATURAL HISTORY OF FISHES.



1. Butterfly Fish, *Blennius ocellaris*, 6 inches. 2. Gattoruginous Blenny, *Blennius gattorugine*, 8 inches. Both are salt-water fish. See p. 240.

LESSON I.—NATURE OF THE STUDY.

1. Oh, what an endless work have I in hand¹,
To count the sea's abundant progeny¹!³
Whose fruitful seed⁴ far passeth those on land,
And also those which fill the azure sky!
'Tis easier far to tell⁵ the stars on high¹,
Although they endless seem¹ in estimation¹,
Than to recount the sea's posterity¹;
So fertile be the floods in generation¹,⁶
So vast their numbers¹, and so numberless their nation.—SPENSER.
2. The sounds and seas¹, each creek and bay¹,
With fry⁷ innumerable swarm¹, and shoals⁸
Of fish that with their fins, and shining scales,
Glide under the green wave, in sculls⁹ that oft
Bank¹⁰ the mid sea. Part single,¹ or with mate¹,
Graze the sea-weed their pasture¹, and through groves
Of coral stray¹; or, sporting with quick glance,
Show to the sun their waved coats dropt¹¹ with gold.—MILTON.

3. Fishes form the last of the four divisions of the vertebrated animals. As inhabitants of a medium so widely different from that in which terrestrial¹² creatures exist, and, in

general, rapidly perishing when withdrawn from their native element, they are much less frequently the objects of our observation than those animals which, as sharing with us the vital¹³ influence of the atmosphere, and being inhabitants of the soil on which we ourselves rest, we meet with at every turn, and with the forms and habits of which we become, almost unconsciously, more or less familiar.

4. Fishes are rarely domesticated¹⁴ in our houses; we do not meet with them in our walks; they are never presented to us in our menageries; nay, we seldom find preparations of them even in our museums: we see them, for the most part, only in our markets or on our tables, and know them chiefly but as administering to our palates. If we follow them to their native haunts,¹⁵ it is too frequently in the same spirit that we pursue the fluttering bird with our gun, or the panting hare with our hounds—in pursuit of a barbarous sport, and with no other end in view than the gratification of vanity in the contemplation of our dexterity in hooking and torturing them.

5. But are fishes, constituting, as they do, the principal inhabitants of by far the largest portion of our globe, worthy of no greater attention than this? Is their structure less wonderful, or are their habits less interesting, than those of the animals with which we are for the most part better acquainted? On the contrary, is it not reasonable to suppose that the investigation of the structure, and functions, and habits of animals so peculiarly circumstanced, will open to us sources of admiration and delight as extensive as they are novel; and, by furnishing us with so many new associations, render us still better informed with respect to animals concerning which we may flatter ourselves we have little or nothing to learn?

6. Fishes may justly be considered to hold an important place in the mighty scale of creation, as furnishing food for man; and, viewed in this light alone, the subject is one of great importance, from the economical and commercial relations which grow out of it. We venture, moreover, to assure the student that, however devoid of interest this department of Natural History may seem to be when viewed from a distance, it offers to him a far greater variety of diversified forms of life than birds and quadrupeds united; and we also assure him that he will not fail to find, throughout its wide domains, numerous illustrations of the wisdom, goodness, and power of the Creator. Nature is ever eloquent:

“Heaven, earth, and sea
Hymn forth the praises of the Deity.”

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| <p>1 ZO-ÛL'-O-ÛY, see Third Reader, p. 240.
 2 ICH-THY-ÛL'-O-ÛY (Greek <i>ichthus</i>, a fish, and <i>logos</i>, discourse.)
 3 PRŪG'-E-NY, inhabitants; descendants.
 4 SEED, offspring; progeny.
 5 TELL, count.
 6 GEN-ER-Ā'-TION, production of inhabitants.
 7 FEY, a crowd of small fish.
 8 SHŌAL, a multitude.</p> | <p>9 SCULL, a shoal or multitude of fish. (No longer used.)
 10 BĀNK, to cause a mound or bank by their numbers.
 11 DROPT, sprinkled or variegated.
 12 TĒR-BES'-TRI-AL, belonging to the land.
 13 VĪ'-TAL, life-sustaining.
 14 DO-MĒS'-TI-Ā-TED, kept in a tame state.
 15 HĀUNTS, retreats; places of resort.</p> |
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LESSON II.—THE PHYSIOLOGY¹ OF FISHES.

1. “OUR plenteous streams a various race supply:
 The bright-eyed perch, with fins of varied dye;
 The silver eel, in shining volumes rolled;
 The yellow carp, in scales bedropt with gold;
 Swift trouts, diversified with crimson stains;
 And pikes, the tyrants of the watery plains.”

2. The natural history of fishes treats of their structure and form, their habits and uses, and their classification. By the term fish we are to understand an animal that has a spinal column or back-bone, and that lives in the water; that has a naked body, or a body covered with plates or scales; that moves commonly by means of fins; that breathes by means of gills instead of lungs; that has a single instead of a double heart; and that has cold instead of warm blood.

3. If these are the characteristics² of fishes, we see the reason why such animals as whales, dolphins, porpoises, seals, and some others, although they live in the water, are not fishes; for all of them breathe by lungs; they have a double heart like that found in man and all the mammalia; and they are warm-blooded. They are therefore included among the mammalia, and have already been described by us in the first great division of Natural History.

4. The blood of fishes generally assumes the temperature³ of the element in which they live. The red blood disks are sometimes circular and sometimes oval; but they are larger than those of the mammalia and birds, and smaller than those of reptiles. But the cold blood of fishes circulates through their bodies, and performs the same office as the warm blood in man—that of building up and repairing the body, and removing its waste and worn-out particles.

5. Fishes, the same as warm-blooded animals, need to have their blood purified by the oxygen⁴ of the air; and they are so formed as to be able to obtain from the air which is in the water a quantity of oxygen sufficient for this purpose. Their

gills, which are placed on each side of the forward part of the body, answer the place of lungs. Here are spread out innumerable blood-vessels, which receive the blood from the heart; and as the water which the fish takes in at the mouth is driven through the gills, the oxygen which it contains passes into the blood, and thus accomplishes the object for which all animals breathe.

6. If by any means the gill-covers, or openings, are kept closed for a short time, the fish will die for want of air to purify the blood, the same as man dies when the air is excluded from his lungs. A fish will die very quickly in the water when its mouth is kept open by a hook, for it can not then cause the water to circulate through the gills; the gill-covers then close, and the air is prevented from reaching the blood. The angler often avails himself of a knowledge of this principle to suffocate or *drown* a strong fish. When a fish is taken out of the water, it opens and shuts its mouth and raises the gill-covers alternately; but as the arches which support the gills collapse,⁵ and it can not raise them without the aid of water, the situation of the fish is similar to that of an air-breathing animal inclosed in a vacuum, and death by suffocation is the consequence.

7. The importance of fishes, as a source of national wealth, renders their geographical distribution a matter of interest and importance; and this seems to be determined by laws quite similar to those which regulate the distribution of land animals. Climate evidently exerts an important influence in regulating the distinctions of form and color between fishes of tropical and those of temperate regions: some species are found only in deep water, and others in shallows; some in fresh, and others in salt water; while, even in the sea, extensive reefs, and even great depths, so effectually divide even kindred species, that the fishes of the coast of the Atlantic States are for the most part distinct from those on the European side of the Atlantic.

8. In the classification of fishes two great divisions are made, the entire class being divided into the two great groups, the BONY and the CARTILAGINOUS. The fishes having bony skeletons are then subdivided into the two classes, the *Spine-rayed* and the *Soft-rayed*—the former having some of their fins furnished with simple bony rays, like spines; and the latter having the fin rays soft and flexible. Fishes may therefore be grouped in three great classes: 1st, the Spine-rayed Bony Fishes; 2d, the Soft-rayed Bony Fishes; and, 3d,

the Cartilaginous Fishes. The latter have the skeleton composed of gristle or cartilage instead of bone.*

- ¹ *PHYS-I-ŌL'-O-ŌY*, the science which treats of the functions of the different parts or organs of animals or plants. ³ *TĒM'-PER-A-TŪRE*, degree of warmth. ⁴ *ŌX'-Y-GEN*. See p. 269; and Fourth Reader, p. 53.
- ² *CHAR-AC-TER-IS'-TICS*, peculiar qualities. ⁵ *COL-LAPSE'*, fall together; close.

* In treating of fishes we have chiefly followed the arrangement of Cuvier, because most works on Ichthyology accessible to students adopt this system, and it is one that is easily understood. The new classification of Agassiz, however, as it better accords with the order of succession which is found to exist in the course of geologic history, will doubtless eventually be adopted in most scientific treatises, and thus some knowledge of both systems will be desirable. Agassiz arranges fishes, in accordance with the peculiar structure of the scales, in the following four orders, a system which is applicable to the fossil as well as the living forms.

1st. *PLACOIDS*—embracing those which, to a cartilaginous skeleton, unite a skin that is covered irregularly with enameled plates or scales, often elevated in the middle, and sometimes with a strong projecting point or spine, as the shagreen on the skin of the sharks, and the tubercles of the rays. Fossils abundant, but existing species few.

2d. *GANOIDS*—embracing all, whether cartilaginous or not, that are covered by a nearly continuous armor of angular scales of enameled bone, or bony plates that fit to each other as the slates on a roof. Examples—sturgeons and gar fish. In a past geological era the ganoids existed in vast numbers, but they have almost entirely disappeared from creation.

3d. *CTENOIDS*—fishes whose scales consist of plates having their posterior edges pectinated or comb-like, such as perches. This is a very large division of existing species.

4th. *CYCLOIDS*—fishes whose scales are entire, and of circular form, as in the salmon, trout, shiners. Also a very large division.

The Ctenoids and Cycloids comprise nearly nine tenths of all existing species. The earliest fossil fish, first appearing near the close of the transition period (see Geology, p. 464), were all *Placoids*. Next in order were the *Ganoids*, which first appear in the lower strata of the secondary period (see Geology, p. 466). These two latter orders comprised, for untold ages, so far as is yet known, all the fish that existed. In the latter part of the secondary period (see p. 468) the Ctenoids and Cycloids were ushered in.



The Common Pike-Perch, *Lucioperca Americana*.

In describing a fish, the size, form, and color are given—the number, character, and position of the fins—and frequently the shape and character of the scales, the character of the gills, and the number of the gill-openings.

The most important and easily recognized of these features are the *fins*; and in describing them the *names* are given, and the number of *spines* or *rays* in each. In the above fish—the Common Pike-Perch of the Great Lakes and Western waters (often, but improperly, called the Pike, or Pickerel)—the fins are briefly described as follows:

D. 14—1, 22; A. 1, 11; C. 17; P. 15; V. 1, 5;

the letters denoting the names of the fins, and the figures the number of spines. There being, in the above fish, two divisions of the dorsal fin, it is designated as D. 14—1, 22; showing that the first dorsal has 14 rays, *all spinous*; in the second dorsal 1 spinous, and 22 that are soft; A. the anal fin, with 1 spinous ray, and 11 that are soft; C. the tail or caudal fin, 17 rays; P. pectoral fin, 15 soft rays; V. the ventral fin, with one spinous ray, and 5 that are soft.

FIRST CLASS OF FISHES.

SPINE-RAYED BONY FISHES. (*Acanthopterygii*.)*

THE PERCH FAMILY.—1. American Yellow Perch, *Perca flavescens*. 2. Striped Sea-bass, *Labrax lineatus*. 3. Black Bass, or Black Perch of Lake Huron, *Huro nigricans*. 4. Growler, or White Salmon of Virginia, *Grystes salmoides*. 5. Black Sea-bass, *Centropistes nigricans*. 6. Mediterranean Apogon, *Apogon trimaculatus*. 7. Two-banded Diploprion, *Diploprion bifaciatum*. 8. One-spotted Mesoprion, *Mesoprion unnotatus*. 9. Ruby-colored Etelis, *Etelis carbunculus*. 10. Armed Enoplossus, *Enoplossus armatus*. 11. Lettered Serranus, *Serranus scriba*. 12. Spined Serranus, *Serranus anthias*. 13. Red Surmullet, *Mullus barbatus*.

LESSON III.—THE PERCH FAMILY. (CTENOIDS.)

1. The spine-rayed bony fishes comprise more than three fourths of all the various kinds that are known. From fourteen to seventeen different families, some of them embracing several hundred species each, have been included in this division. At the head of the whole stands the Perch family, the most numerous of all. Most of them are salt-water fish, but about one fifth of the whole number inhabit fresh-water streams, or occasionally ascend them from the sea.

* A-CAN-THOP-TER-YŪ'-II, from two Greek words, *acanthos*, a thorn, and *pteronion*, a little wing or fin, meaning thorny or spine-rayed. The fishes of this order are distinguished by having the anterior portion of the dorsal, or of the first dorsal where there are two, supported by spinous rays consisting of single bony pieces. Spinous rays are also found in the anal, and at least one in the ventral fins.

2. Those which are usually known by the name of perch, however, are fresh-water fish, and they have been celebrated from the time of Aristotle for their beautiful forms, and the excellence of their flesh as an article of food.

Nor let the muse, in her award of fame,
Illustrious Perch, unnoticed pass thy claim;
 Prince of the pricely cohort, bred in lakes
 To feast our boards, what sapid¹ boneless flakes
 Thy solid flesh supplies! Though river-fed,
 No daintier fish in ocean's pastures bred
 Swims thy compeer; scarce mullet may compete
 With thee for fibre firm and flavor sweet.—AUSONIUS.

3. In the Perch family are included no less than five different kinds of perch found in our waters, the pike-perch, numerous species of bass, the growler, or white salmon of Virginia, and many other species, exhibiting a great variety of form and coloring, found on the European and Asiatic coasts. Their general character, as to form and size, will best be learned from the representations given in the engraving at the head of this lesson. All the fishes of this family agree in the toothed or comb-like edges of their scales, and in having notched or spined gill-covers; but, while some have but one dorsal fin, in others there is a division, constituting two.

4. The European river perch, like our common yellow perch, is exceedingly voracious. An anecdote is related of a gentleman who, in fishing, lost a perch from his line, the hook tearing out the eye of the poor creature. He then adjusted the eye on the hook and replaced the line in the water, where it had hardly been a few minutes before the float was violently jerked under the surface. On landing the fish, he found he had captured a fine perch, which proved to be the very fish which had just been mutilated, and which had actually lost its life by devouring its own eye. It is quaintly observed by Izaak Walton, that "if there be twenty or forty in a hole, they may be at one standing all caught, one after another, they being, like the wicked of the world, not afraid, though their fellows and companions perish in their sight."

5. The incident related concerning the perch is one among many facts that might be given, showing how erroneous is the idea that "the worm on which we tread feels a pang as great as when a giant dies." On the contrary, the nervous organization of the lower orders of animals is such that they seem to suffer but little, compared with what man endures, in being maimed or killed. This is, assuredly, a most benevolent provision, greatly diminishing the amount of suffering that would otherwise be endured throughout all animated nature.

6. Of all the beautiful colored fish, several species of which belong to the Perch family, it may be remarked that they can never be seen in perfection except when newly taken from the water. Then their beauty is fresh and delicate, but it changes as soon as the fish dies; and the keeping for a day, or preservation in spirits, destroys all but the mere traces of their delicate markings.

7. Of the little spined serranus, which was well known to the ancients, and is still very abundant in the Mediterranean, very curious and remarkable stories are told; but as they are only *fish* stories, we can not insist that our readers shall believe them. It will be observed that the forward dorsal fin of this fish is armed with long and sharp spines, the third one of which is much the longest. From the supposed resemblance of this spine to a razor, the French call this fish "The Barber."

8. The long spines of the serranus are considered a very formidable weapon of defense; and by the divers for marine productions the fish itself is regarded as sacred, because they declare that no other fish, however large, dare approach its retreats, and that there is always safety from the attacks of sea-monsters wherever this little fish is found. Moreover, the divers assert that whenever one of these fish is caught by a hook, the rest of the shoal immediately cut the line by rushing against it with their sharp spines, and thus relieve their companion.

9. In the Perch family is a small fish called the red surmullet, which is supposed to be the fish so celebrated among the Romans for the excellence of its flesh, its extreme beauty, and the extravagant sums paid for it. It appears to have been esteemed by the Roman epicures² above every other article of food; and the larger ones, weighing five or six pounds, were obtained only at prodigious prices. Juvenal says:

"Six scanty pounds the mullet weighed;
Six thousand sesterces³ the wise man paid!"

Seneca mentions that a surmullet of four pounds' weight was presented to the Emperor Tiberius, who sent it to the market, where it was purchased for five thousand sesterces; and at a later period one was sold for eight thousand sesterces, a sum equal to more than three hundred dollars of our money.

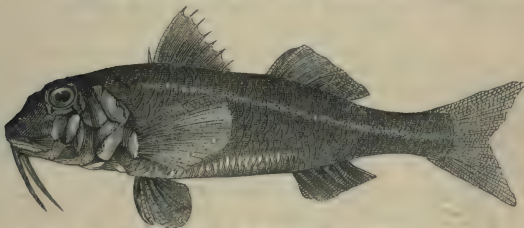
10. While with these Roman epicures the smaller the *turbot* the greater the prize, yet they eagerly sought for the largest specimens of the *mullet* that could be procured. Horace supposes this mere caprice, and asks,

"Of *carps* and *mullet* why prefer the great,
Though cut in pieces ere my lord can eat,
Yet for small turbot such regard profess' ?
Because God made this large', the other less'."

11. It has been truly remarked that mullets stand pre-eminent in the annals of human luxury, cruelty, and folly. In their feasts the Romans reveled over the dying surmullet, while the bright red color of health passed through various shades of purple, violet, blue, and white, as life gradually ebbed, and convulsions put an end to the admired spectacle. They put these devoted fish into crystal vessels filled with water, over a slow fire, upon their tables, and complacently regarded the lingering sufferings of their victims as the increasing heat gradually prepared them for their pampered⁴ appetites.

12. Probably the changes which the blood underwent in the minute capillaries,⁵ as it was gradually deprived of its life-preserving oxygen, produced those varied hues which the poet has so well described :

"It dies like parting day ;
—each pang imbued
With a new color, as it gasps away,
The last still loveliest, till—'tis gone, and all is gray."



Striped Red Mullet, *Mullus surmuletus*.

The striped red mullet, a beautiful fish of a pale pink color, but somewhat larger than the one known to the Romans, is found in considerable numbers on the English coasts. The mullets, like the cod and some other fish which feed in deep water, are furnished with long *feelers* attached to the lower jaw, supposed to be delicate organs of touch, by which these fish are enabled to select their food on the muddy bottoms.

¹ SĀP'-ID, well-tasted ; savory ; palatable.

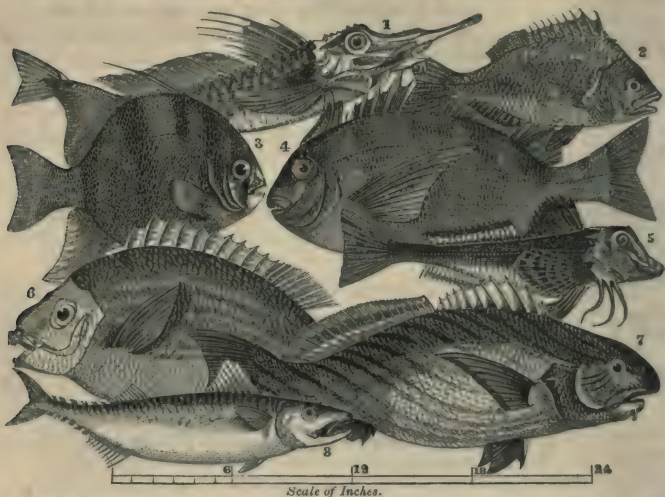
² EP'-I-CŪEE, one who indulges in the luxuries of the table.

³ SĒS'-TEECĒ, a Roman coin, about four cents.

⁴ PĀM'-PERED, fed to the full ; glutted.

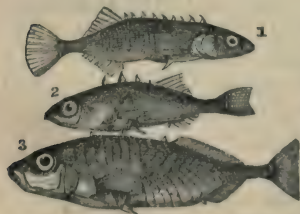
⁵ CĀP'-IL-LA-RY, a small blood-vessel ; see Fourth Reader, p. 59, 60.

LES. IV.—OTHER FAMILIES OF THE SPINE-RAYED FISHES.



1. Mailed Gurnard, *Peristedion malmat*. 2. Big Porgy, *Pagrus argyrops*. 3. Banded Ephippus, or Three-tailed Porgy, *Ephippus faber*. 4. The Sheephead (famed for its exquisite flesh), *Sargus ovis*. 5. Streaked or Rock Gurnard, *Trigla lineata*. 6. Axillary Sea Bream, *Pagellus acarne*. 7. Bearded Umbrina, *Umbrina vulgaris*. (The Umbrina is given as the representative of the family of the *Maigres*, which includes our Weak-fish, Corvinas, the Chub, King-fish, and the *Drum*, the latter noted for the loud drumming noise which it makes, and the cause of which is still a mystery.) 8. Common Mackerel, *Scomber scomber*.

1. Of the remaining numerous families of the spine-rayed division of fishes, most of which are represented in the accompanying illustrations, only a very brief description can here be given.



1. Ten- (or Nine-) spined Stickleback, *Gasterosteus pungitius*. 2. Four-spined S., *G. spinulosus*. 3. Short-spined S., *G. brachycentrus*.

2. The Gurnards, or Mailed-checks, which are abundant on our northern coasts, are a numerous family of marine fishes, which have received their common name from the growling or grunting noise which they make when sporting in the water, or when recently taken from it. The Sticklebacks—a division of the same family, so named from the spines which arm their backs

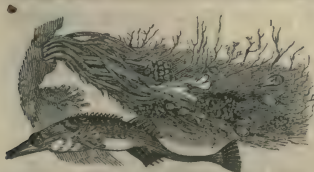
and fins—are mostly small fishes, of from one to three inches in length, and very numerous both in fresh and salt water. They are exceedingly active and greedy, very destructive to small fish of other species, which they devour, and therefore very injurious in fish-ponds; and they also have furious contests with each other. The fifteen-spined stickleback, found on the English coasts, is noted for its nest-building propensities.* The following account of the fighting habits of the sticklebacks is given by a contributor to an English magazine:

3. "When a few are first turned into a large wooden vessel, they swim about, apparently exploring their new habitation. Suddenly one will take possession of a particular corner of the tub, or, as will sometimes happen, of the bottom, and will instantly commence an attack upon his companions; and if any one of them ventures to oppose his sway, a regular and most ferocious battle ensues: the two combatants swim round and round each other with the greatest rapidity, biting and endeavoring to pierce each other with their spines.

4. "I have witnessed a battle of this sort which lasted several minutes before either would give way; and when one does submit, imagination can hardly conceive the vindictive fury of the conqueror, who, in the most persevering and unrelenting way, chases his rival from one part of the tub to another, until fairly exhausted with fatigue. They also use their spines with such fatal effect, that, incredible as it may appear, I have seen one, during a battle, absolutely rip his opponent quite open, so that he sank to the bottom and died. I have occasionally known three or four parts of the tub taken possession of by as many little tyrants, who would guard their territories with the strictest vigilance; and the slightest invasion would invariably bring on a battle."

5. The tropical species of the large family of the "Scaly Fins," among which is included the New York porgee, are conspicuous for the extreme splendor of their coloring, which is thus spoken of by an eminent English naturalist, Dr. Hamilton:

"If," he remarks, "the feathered tribes of the equatorial regions are bedecked with the most brilliant and gorgeous hues, the neighboring oceans contain myriads of the finny race which in this respect excel them. Upon the group of the Chetodons, especially, Nature has most profusely lavished

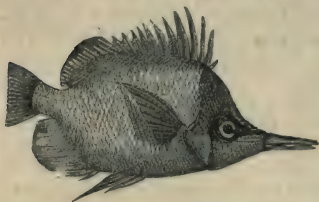


Fifteen-spined Stickleback, nest and eggs.

* The fifteen-spined stickleback, a salt-water fish, often called the sea-adder, sometimes attains a length of six or seven inches. This fish deposits its spawn amid the fine growing sea-weed. Around the eggs, which are of the size of small shot, it then gathers the branches, which it binds together in a compact mass with an exceedingly fine and tough elastic thread, which seems to be formed of some albuminous secretion. Other instances of this nest-building propensity are found in some fresh-water fishes of Demerara, which not only construct nests of grass, but which also burrow in the banks of streams.

these splendid ornaments. The purple of the iris, the richness of the rose, the azure blue of the sky, the darkest velvet black, and many other hues, are seen commingled with metallic lustre over the pearly surface of this resplendent group, which, habitually frequenting the rocky shores at no great depth of water, are seen to sport in the sunbeams, as if to exhibit to advantage their gorgeous dress.

6. "Several of the genera," farther remarks this writer, "are moreover distinguished by an extraordinary habit of shooting their prey by projecting a liquid stream from their mouths. Thus the genus *Chelmon* contains a species six or eight inches in length, which, when it perceives a fly, or other winged insect, hovering near it, or settled on a twig, propels against it, with considerable force, a drop of liquid from its mouth, so as to drive it into the water.



Long-beaked Chelmon, *Chelmon longirostris*.

7. "In attacking an insect at rest, it usually approaches cautiously, and very deliberately takes its aim. It is said to be an amusement with the Chinese in Java to keep this fish in confinement in a large vessel of water, that they may witness its dexterity. They fasten a fly, or other insect, to the side of the vessel, when the chelmon aims at it with such precision that it rarely misses its mark. The archer, again, belonging to another genus of this family, shoots his watery deluge to the height of three or four feet, and strikes almost without fail the insect at which it aims."

8. Although most fish soon die when taken out of their native element, yet some species are known to make their way over land from one piece of water to another; and, stranger still, there is one kind, a native of India, about the size and figure of a perch, and usually called the climbing perch, which has been known to climb bushes of considerable height. This it does by the aid of its long ventral fins, which it uses as feet. These fish are enabled to retain sufficient moisture to keep their gills moist and open for a considerable time; and it is well known that it is not the abundance of air, but the want of it, which kills fish when taken out of the water.

9. The Mackerel family, the most numerous of the bony fishes after the perches, includes more than three hundred species, mostly marine fish, crowding the surface of the ocean, especially in warm latitudes, and having an extensive range. Amid great diversities of size and form, extending from the little mackerel to the monster sword-fish, the numerous members of this family possess certain characters, such as very minute scales, and gill-covers without spines or notches, which give to the whole a family resemblance that is not easily mis-

taken. The common mackerel is not only beautiful in form, but also, when seen in its native element, brilliant in coloring. (See cut, Fig. 8, p. 232.)

10. This family is one of the most useful to man, many of the species constituting excellent food, their size being considerable, and their reproduction enormous; and as they are brought periodically, by a wise provision of the Creator, from the depths of the ocean to shallow waters to deposit their eggs or spawn, they become the objects of highly valuable and inexhaustible fisheries. If the mackerel were dispersed over the immense surface of the deep, no effective fishery could be carried on; but, approaching the shore as they do from all directions, and roving along the coasts in immense shoals, millions are caught, which yet form a small portion compared with the myriads which escape.

11. The common tunny,* a large fish of the Mackerel family, often measuring ten or twelve feet in length, and sometimes weighing over a thousand pounds, is occasionally brought into the New York markets; but in the Mediterranean Sea the smaller species of this fish swarm at certain seasons of the year, and are taken in immense numbers. A favorite time for catching them seems to have been at the full of the moon, when, allured by the silvery light, they glide in great bands over the surface of the water. An ancient Greek poet thus alludes to their capture at this season:

“The nets have been thrown, and on careless fin
The moonlit tunnies will soon rush in.”

The striped tunny, a smaller fish, is well known in Southern seas, where in great troops it pursues the flying-fish over the vast waters, as herds of wolves do the bison on our Western prairies.

12. The sword-fish,† another member of the great Mackerel family, usually measuring from eight or ten to eighteen feet in length, is an occasional frequenter of our waters. In 1840 the New York markets were abundantly supplied with this fish, whose flesh is preferred to halibut or sturgeon, which in flavor it somewhat resembles. - The most striking feature in this fish is its long, sword-like muzzle, with finely-toothed edges, a powerful instrument which threatens every thing that approaches it. More than two thousand years ago the poet Sophocles thus alluded to it:

“What Fury, say, artificer² of ill,
Armed thee, O Xiphias,³ with thy pointed bill?”

* See engraving, page 237.

† See the representation of this fish (*Xiphias gladius*), page 237.

The sword-fish is reported to have violent contests with the whale, of which the following, quoted from a reliable work, is a striking example:

13. "One morning, as stated by the captain of an English vessel, during a calm, when near the Western Isles of Scotland, all hands were called up at three in the morning to witness a battle between several fish called thrashers, or fox-sharks, and some sword-fish on the one side, and an enormous whale on the other. It was in the middle of summer, and the weather being clear, and the fish close to the vessel, we had a fine opportunity of witnessing the contest.

14. "As soon as the whale's back appeared above the surface, the thrashers, springing several yards into the air, descended with great violence upon the object of their rancor,⁴ and inflicted upon him the most severe slaps with their tails, the sounds of which resembled the reports of muskets fired at a distance. The sword-fish, in their turn, attacked the distressed whale, stabbing from beneath, so that the water to a great distance around was dyed with blood. In this manner they continued tormenting and wounding him for many hours, until we lost sight of him; and I have no doubt that in the end they completed his destruction."

15. It is probably by mistaking a vessel for one of these great monsters of the deep that the sword-fish has been known to try his strength against a gallant ship. Those on board have sometimes, from the violence of the shock, found it difficult to believe that they had not struck some hidden rock, such being the weight and power of the fish; and specimens of ships' timbers penetrated by the sword of the fish, which is sometimes broken off and left in the wood, are not uncommon. The poet Oppian describes this fish as attacking even rocks themselves:*

"Struck by the blade, the sounding stone gives way,
And shatter'd rocks their secret veins display."

16. As the weapon of the sword-fish is very destructive to nets, the harpoon has always been a favorite method for capturing large specimens. Oppian further relates that the sailors of the Tyrrhine Sea constructed, with this view, certain light skiffs, built to resemble the sword-fish, which the latter, mistaking for so many new acquaintances of their own species, approach in foolish confidence, and thus are easily destroyed by the harpooners. We give the poet's narration, without, however, vouching for its truth.

17.

"To fishy forms th' artistic builders lend
Mimetic⁵ fins, and wooden sword pretend.⁶
With secret joy each xiphias views his friends,
And kindly instincts aid man's treacherous ends.
Anon the crafty boatmen, closing round,
The trident⁷ hurl, and deal the deadly wound.
The goaded⁸ fish, experience bought too late,
Escapes, but oft still battles hard with fate;
Unvanquish'd, summons to his instant aid
The oft-tried prowess⁹ of his trusty blade;

Selects some boat, and runs his powerful sword
Full many an inch within the fatal board:
There holds no more, the doughty¹⁰ weapon yields,
And crimson with his blood the briny fields."

¹ I'-BIS, a plant of that name. See p. 187.

² ÅR-TIF'-I-OER, a skillful workman.

³ XIPH'-I-AS, the Latin name of the sword-

⁴ RAN'-EOR, inveterate enmity.

⁵ MI-MET'-IC, imitative.

⁶ PRO-TEND', stretch forth.

⁷ TRÍ'-DENT, a spear with three prongs.

⁸ GOAD'-ED, pricked with the goad or spear.

⁹ PROW'-ESS, bravery; skillful valor.

¹⁰ DOUGH'-TY (*dow'-ty*), brave; illustrious.

LESSON V.—THE SPINE-RAYED FISHES CONTINUED.

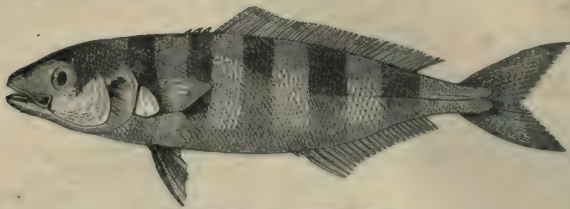


1. Common Sword-fish, *Xiphias gladius*. 2. Indian Sword-fish, *Histiophorus Indicus*. 3. Common Tunny, *Thynnus vulgaris*. 4. Dolphin of the ancients, *Coryphæna hippurys*. 5. Scabbard-fish, *Lepidopus argyreus*. 6. Wolf-fish (a fighting character, belonging to the family of the Gobies), *Anarrhichus lupus*. 7. Fishing Frog, *Lophius piscatorius*.

1. THE several species of the Pilot-fish, of which so many curious stories have been told, also belong to the Mackerel family. The ancient naturalists asserted that the common pilot-fish, which is a pretty little fish about a foot in length, joins company with the tempest-toss'd bark of the anxious mariner, indicates to him his nearest course to land, and leaves him as soon as it has fulfilled this kind office.

2. Others, with much reason, deny this assertion, and allege that the pilot, like the shark, follows vessels for the purpose of obtaining a share of the garbage¹ which may be thrown

overboard. Certain, however, it is, that their perseverance in this respect is very singular, as is narrated in the case of an English vessel which was accompanied by two pilot-fish during its entire voyage of eighty days from Alexandria, in the Mediterranean, to Plymouth.



The Pilot-fish, *Naucrates ductor*.

3. It is a current opinion among sailors that this fish acts a pilot's part to the shark, and accompanies and befriends it as opportunity offers; and certainly there is a great amount of evidence which goes to show that there is something very much like a confiding familiarity between these two companions of the weary mariner. Numerous well-authenticated cases like that which we quote from Cuvier, respecting the habits of this fish, might be given.

4. With the ancients, however, as described by their poets, this little fish was the faithful companion of the *whale* instead of the shark; and Oppian thus alludes to the services which these pigmy pilots render to their unwieldy associates:

“ Bold in the front the little pilot glides,
Averts each danger, every motion guides;
With grateful joy the willing whales attend,
Observe the leader, and revere the friend.
Where'er the little guardian leads the way,
The bulky tyrants doubt not to obey,
Implicit trust repose in him alone,
And hear and see with senses not their own.”

When, and on what grounds, the misunderstanding of the pilot with his “fat friend” took place, history fails to inform us; but that he is now the ally of the dreaded shark, whom he escorts in safety through every sea, is matter of general notoriety and almost daily observation. The following is the extract from Cuvier:

5. “ Captain Richards, of the Royal Navy, during his station in the Mediterranean, saw on a fine day a blue shark, which followed the ship. After a time a shark-hook, baited with pork, was flung out. The shark, attended by four pilot-fish, repeatedly approached the bait; and every time he did so, one of the pilots, which preceded him, was distinctly seen from the taff-rail² of the ship to run his snout against the side of the shark's head to turn it away.

6. "After this had continued for a time, the shark swam off in the wake^s of the vessel, his dorsal fin being long distinctly visible above the water. When he had gone, however, a considerable distance, he suddenly turned round, darted toward the vessel, and before the pilot-fish could overtake him and interpose, snapped at the bait, and was taken. In hoisting him on board, one of the pilot-fish was observed to cling to his side until he was half above water, when it fell off. All the pilots then swam about for a while, as if in search of their friend, with every apparent mark of anxiety, and then darted suddenly into the depths of the sea."

7. The dory, or John Dory, a fish of grotesque figure and uncommon colors, from twelve to eighteen inches in length, also belongs to the Mackerel family, although differing much in form from its kindred. In many towns on the Mediterranean it is called "St. Peter's fish," it being alleged that it was from the mouth of a fish of this species that the apostle obtained the coin to pay the tribute-money, and that the imprint of his two



The Dory, *Deus faber*.

fingers marks the species to the present day.

8. The fish generally known as the "dolphin of the sailors," and celebrated by the poets for its resplendent hues, "changing as it dies," also belongs to the famous Mackerel family. It is an active, voracious animal, greedily pursuing the flying-fish, which constitute its favorite food. When in eager pursuit of its prey, the undulations of its large dorsal fin reflect its varied markings of silvery blue and golden yellow with unwonted brilliancy. A scene at sea, in which a shoal of these fish are observed sporting in their native element, and a whale making his appearance near by, is thus beautifully described by the poet Montgomery :

9.

"Next on the surge,

A shoal of dolphins, tumbling in wild glee,
Glowed with such orient^t tints, they might have been
The rainbow's offspring, when it met the ocean.
While yet in ecstasy I hung o'er these,
With every motion pouring out fresh beauties,
As though the conscious colors came and went
At pleasure, glorying in their subtle changes—
Enormous o'er the flood, Leviathan
Looked forth, and from his roaring nostrils sent
Two fountains to the sky, then plunged amain
In headlong pastime through the closing gulf."

10. Of the family of the ribbon-shaped fish, which contains about thirty known species, we have given, in the engraving at the head of this lesson, only one specimen, the scabbard-

fish. Concerning this family we quote from an eminent English naturalist, Mr. Swainson, the following remarks :

11. "This family contains the most singular and extraordinary fishes in creation. The form of the body, when compared to fishes better known, is much like that of an eel, the length being in the same proportion to the breadth ; but then it is generally so much compressed that these creatures have acquired the popular name of *ribbon-fish*, *lath*, or *deal-fish*. The body, indeed, is often not thicker, except in its middle, than a sword ; and as it is of the richest silver in brightness, and of great length, the undulating motion of these fishes in the sea must be resplendent and beautiful beyond measure. But these wonders of the mighty deep are almost hidden from the eye of man. These meteoric fishes appear to live in the greatest depths ; and it is only at long intervals, and after a succession of tempests, that a solitary individual is cast upon the shore with its delicate body torn and mutilated on the rocks."

12. Of the family of the Mulletts, which differ from the Surmulletts already described, and of the family of the Blennies or Gobies, which are mostly small fish, we have many species on our coasts. Two of the blennies are pictured on page 223. Nature has endowed the mullets with a power which often aids their escape from the nets of the fisherman, and which is thus alluded to by the poet Oppian :

"The mullet, when encircling seines⁵ inclose,
The fatal threads and treacherous bosom knows.
Instant he rallies all his vigorous powers,
And faithful aid of every name implores ;
O'er battlement of cork up-darting flies,
And finds from air th' escape which sea denies."

When one takes the leap, the others, like sheep, follow instantly in succession.

13. The most grotesque-looking fishes of all that belong to the spine-rayed division are those which are embraced in the family of the Lophidæ. Here is found the famous fishing-frog, or angler, whose boldness and voracity, and peculiar modes of taking its prey, to say nothing of its uncouth form, have rendered it perhaps more celebrated than any other fish of equal size.

14. The angler is said to fish both with the net and with the line, luring⁶ its victims to destruction by means of the long thread-like streamers or feelers which issue from the top of its enormous head, and capturing them in the great sacs connected with its mouth and gills. The following is said to be the mode of procedure. The angler, lying close to the bottom, stirs up the sand or mud by means of its ventral and pectoral fins ; hidden by the obscurity thus produced, it elevates its feelers, moves them in various directions by way of attracting as a bait, and then by a rapid movement seizes the fish which approach to examine them.



1. Blue-striped Wrasse, *Labrus mixtus*. 2. Trumpet-fish, Sea-snipe, or Bellows-fish, *Centriscus scolopax*. 3. American Tautog, *Tautoga Americana*.

15. The family of the Wrasses, or Rock-fish, includes our common bergalls, the New York tautog or common black-fish, and those fancy-colored species known as "old wives of the sea." Of the latter there are several varieties, such as the *red* old wife, the *blue* old wife, and the *yellow* old wife, which are so named in accordance with their prevailing colors. The thick pouting lips of the fish of this family are their most striking characteristic. The Wrasses were known to the poet Oppian, who describes the beds of sea-weed as their favorite places of resort:

"And there thick beds of mossy verdure grow—
Sea-grass, and spreading wrack are seen: below,
Gay rainbow-fish, and sable wrasse resort."

16. The last family that we have to notice in the spine-rayed division is that of the Trumpet fishes, which are distinguished by their long tubular beak, through which it is believed they draw their food as water is drawn up the pipe of a syringe. The above drawing of this singular fish will give a better idea of it than any detailed description.

¹ GÄEB'-AGE, waste meat; any thing of no value.

² TÄFF'-EAIL, the uppermost rail of a ship's stern.

³ WÄKE, track of a vessel in the water.

⁴ Ö'-BI-ENT (Fastern), bright; shining.

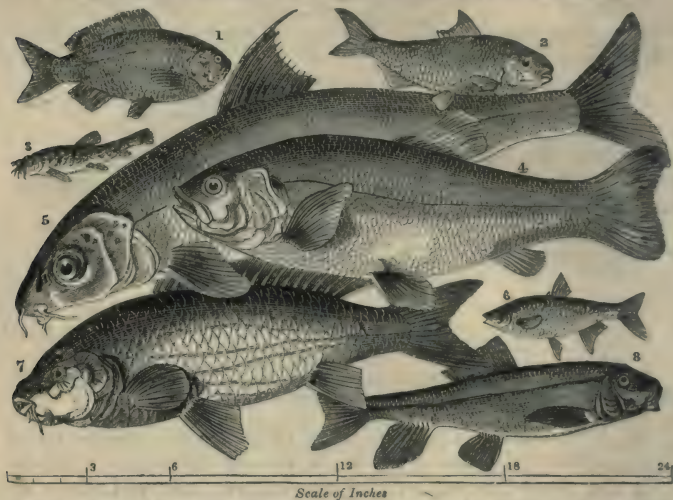
⁵ SÄLNE (seen), a large net for taking fish.

⁶ LÜR'-ING, enticing.

SECOND CLASS OF FISHES.

SOFT-RAYED BONY FISHES. (*Malacopterygii*)*

[Carp, Pike, Cat-fish, Salmon and Trout, and Herring and Pilchard Families.]



THE CARP FAMILY.—1. Golden Carp, or Gold-fish, *Cyprinus auratus*. 2. The Roach, *Leuciscus rutilus*. 3. The Loach, or Beardie, *Cobitis barbatula*. 4. The Tench, *Tinea vulgaris*. 5. The Barbel, *Barbus vulgaris*. 6. New York Shiner, *Cyprinus crysoleucas*. 7. Common Carp, *Cyprinus carpio*. 8. Common New York Sucker, *Catostomus communis*.

LESSON VI.—SOFT-RAYED BONY FISHES WITH ABDOMINAL VENTRAL FINS.

1. THE carps may be placed at the head of the soft-rayed division. They are the least carnivorous¹ of all fishes, and embrace, besides the common carp and its kindred, the several species of the barbel, the gudgeon, the tench, the roach, the dace and shiners, the minnows, the loach, and the American suckers. They are the most abundant fish in the fresh-water streams of Europe and America.

2. The common carp, which has been called the water-fox on account of his cunning, is a European fish, which has been naturalized in American waters. Another species, originally

* MAL-A-COP-TER-YŪ'-II, from two Greek words, *malakos*, "soft," and *pterygion*, a little wing or "fin"—meaning those fish which are soft-finned or soft-rayed. The fin rays in these fish are composed of bony pieces united by means of cartilage, which renders the fin-rays much more flexible than is seen in the long single spines of the class first described.

brought from a mountain lake in China, but now domesticated in almost every country of the Old and the New World, is the gold-fish—those beautiful pets and playthings which have attracted so much attention and admiration on account of the exceeding brilliancy of their coloring. They are usually kept in glass globes filled with water, where their golden hues are reflected to the best advantage. Moore, in his *Lallah Rookh*, alludes to them in the following lines:

“On one side, gleaming with a sudden grace
Through water, brilliant as the crystal vase
In which it undulates, small fishes shine,
Like golden ingots² from a fairy mine.”

3. And very beautiful is the allusion which the poet Wordsworth makes to the crystal vase in which they are usually kept:

“Type of the sunny human breast
Is your transparent cell,
Where fear is but a transient guest,
Nor sullen humors³ dwell;
Where, sensitive of every ray
That smites this tiny⁴ sea,
Your scaly panoplies⁵ repay
The loan with usury.”

4. The Chinese ladies pay great attention to the rearing of these fish, having the richest glass vessels prepared for them in their apartments, and small ornamental ponds and basins in their gardens. If they are obliged to transport them from one vessel to another, they take great care not to touch them with the hand, and not to remove them entirely from the water. In this country they are usually fed with crumbs of bread, and yolks of eggs boiled hard and reduced to powder, and occasionally they should be supplied with a bed of moss or turf. A writer, in the following lines, seems to doubt the justice of making them prisoners for our pleasure:

5. “I ask what warrant fix’d them (like a spell
Of witchcraft, fix’d them) in the crystal cell;
To wheel, with languid motion, round and round,
Beautiful, yet in mournful durance⁶ bound¹?
Their peace, perhaps, our slightest footstep marr’d¹,
Or their quick sense our sweetest music jarr’d¹;
And whither could they dart, if seized with fear¹?
No sheltering stone’, no tangled root was near¹.
When fire or taper ceased to cheer the room’,
They wore away the night in starless gloom¹;
And when the sun first dawned upon the streams’,
How faint their portion of its vital beams¹!
Thus, and unable to complain, they fared,
While not one joy of ours by them was shared.”

6. The golden carp, or gold-fish, vary not only in color, but in the shape, size, and number of their fins also. In color they exhibit almost every possible shade or combination of silver, brilliant orange, and purple. Some have dorsal fins extending

more than half the length of the back ; others have dorsal fins of five or six rays only ; and still greater variations sometimes are seen in other fins. These changes are supposed to have been produced by domestication.

7. The European tench, which is a fish from twelve to eighteen inches in length, also belongs to the Carp family. It loves muddy waters, is exceedingly tenacious of life, and has the reputation, among fishermen, of being the physician of fishes. In Germany it is called the doctor-fish. Even the pike, the tyrant of the streams, is said never to prey upon the tench, which is supposed to exert his healing powers by rubbing against the sides of the sick or wounded. Of the pike it has been written :

" The tench he spares ;
For when by wounds distress'd, or sore disease,
He courts the salutary fish for ease ;
Close to his scales the kind physician glides,
And sweats the healing balsam from his sides."

8. Some of the fish of the Carp family, such as the roach, dace, and shiners, have scales of a very peculiar silvery lustre, whose brilliancy is owing to a silvery pigment⁷ on the inner surface of the scales. The French have taken advantage of the coloring matter thus afforded to imitate Oriental pearls, and have established extensive manufactories of "patent pearls," that are used for beads, necklaces, ear-drops, and other ornaments. At present these artificial pearls are confined chiefly to ornaments attached to combs, or small beads arranged with flowers for head-dresses.

9. In the Pike family, the next in order to the Carps, the most important are the common pike or pickerel, the gar-fish, the saury pike, and the common flying-fish. The fishes of this family are voracious ; in form they are long and slender, and the single dorsal fin is usually far back on the body. The epithets which have been applied to the pike, such as the "fresh-water shark," and the "tyrant of fresh waters," express its well-marked and most striking trait. It has formidable rows of teeth in both jaws ; and not only fish, but also frogs, water-rats, and even water-hens and other fowl, often become its prey.

10. The pike is believed to be the only fresh-water fish which is undoubtedly common to the Eastern and Western continents ; yet in America it is said to be confined to the eastern side of the Rocky Mountains. The gar-fish or sea-pike, and the saury pike, both salt-water fish, are more slender than the common pike. The former is a very active and playful fish :



THE PIKE FAMILY.—1. Saury Pike, *Scomber-esox saurus*. 2. Common Pike, *Esox lucius*. 3. Common Gar-fish, *Belone vulgaris*. 4. Guiana Gar-fish, *Belone Guianensis*. 5. Common Flying-fish, *Exocoetis volitans*.

it swims near the surface; and its vivacity is such that it will for a long time play about a floating straw, and leap over it many times in succession.

11. A modern Italian poet thus writes of the gar-fish, and of a curious method of capturing them which was said to be employed successfully at Naples:

“Burnish’d with blue, and bright as damask steel,
Behold the *belone*,⁹ with pointed bill
All fringed with teeth: no greedier fish than they
E’er broke in serried⁹ lines our foaming bay.
Soon as the practiced crew this frolic throng
Behold advancing rapidly along,
Adjusting swift a tendon to the line,
They throw, then drag it glistening through the brine.
Quickly the lure the snapping fish pursue:
The gristle charms, but soon its charms they rue.
Fix’d by the teeth to that tough barbless bait,
The struggling suicides succumb¹⁰ to fate.”

12. The flying-fish, of which there are several species, are easily distinguished by the excessive size of their pectoral fins, which are sufficiently large to support them in the air for a few moments. But these fish do not in reality fly; it is only after a rapid course of swimming that they can leap into the air: then they do not flap their fins, and they never raise themselves above the height to which they first spring.

Their most usual height of flight above the surface of the water is only two or three feet; but the larger species sometimes spring fifteen or twenty feet, and it is not unfrequent for whole shoals of them to fall on board of ships that navigate the seas of warm climates.

13. The flying-fish are usually regarded with much interest by the mariner in tropical seas, as they are sometimes the only objects that for hours, and even days, break in upon the monotony¹¹ of the scene. Their sudden darting upon the sight, and as sudden departure, like flashes of momentary light, are thus described by the poet Montgomery:

"Yet while I look'd,
A joyous creature vaulted through the air—
The aspiring fish that fain would be a bird,
On long, light wings, that flung a diamond-shower
Of dew-drops round its evanescent¹² form,
Sprang into light, and instantly descended."

14. In its own element the flying-fish is perpetually harassed by the dorados, tunny, bonito, and other fishes of prey. If it endeavors to avoid them by having recourse to the air, it either meets its fate from the gulls or the albatross which are constantly on the alert to seize it, or it is forced down again into the mouths of other enemies who keep pace below with its aerial excursion. Yet the flying-fishes themselves



THE CAT-FISH FAMILY.—1. Brown Cat-fish, *Pimelodus pullus*. 2. Common Cat-fish, or Horned Pout, *Pimelodus catas*.

The Cat-fish family embraces the numerous fresh-water fish which are known in this country by the common names of cat-fish, horned pouts, and bull-heads. They mostly inhabit muddy streams and lakes, are destitute of scales, sluggish in their movements, and, like the famous fishing-frog or angler, to which they bear some resemblance, depend more upon stratagem than swiftness to seize their prey. The different species vary in length from three or four inches to four feet; and some are said to have been caught in the Ohio and Mississippi rivers measuring eight feet in length.

feed on smaller fish, and these latter on those still below them; and thus, in one continued round of rapacity, the inhabitants of the deep prey upon each other.

¹ ĊĀR-NĪV'-O-ROUS, feeding on flesh.

² ĪN'-GOT, an unwrought bar of gold.

³ HŪ'-MOR, fancy; caprice.

⁴ TĪ'-NY or TĪN'-Y, very small; little.

⁵ PĀN'-O-FLY, defensive armor.

⁶ DŪR'-ANCE, imprisonment.

⁷ PĪG'-MENT, a paint.

⁸ BĒL'-O-NE, Latin name for this fish.

⁹ SĒR'-RIED (*sēr'-riid*), close; crowded.

¹⁰ SŪC-ĊŪMB', yield; submit to.

¹¹ MO-NŌT'-O-NY, uniformity; want of variety.

¹² EV-Ā-NĒS'-ĊENT, fleeting; quickly passing away.

LESSON VII.—TO THE FLYING-FISH.

1. WHEN I have seen thy snow-white wing
From the blue wave at evening spring',
And show those scales of silvery white,
So gayly to the eye of light',
As if thy frame were formed to rise,
And live amid the glorious skies',
Oh, it has made me proudly feel
How like thy wing's impatient zeal
Is the pure soul', that rests not, pent
Within this world's gross element',
But takes the wing that God has given',
And rises into light and heaven'!
2. But when I see that wing so bright
Grow languid with a moment's flight,
Attempt the paths of air in vain,
And sink into the wave again',
Alas'! the flattering pride is o'er';
Like thee', a while', the soul' may soar',
But erring man must blush to think,
Like thee', again', the soul' may sink'!
3. O Virtue'! when thy clime I seek',
Let not my spirit's flight be weak';
Let me not, like this feeble thing,
With brine still dropping from its wing',
Just sparkle in the solar glow,
And plunge again to depths below';
But, when I leave the grosser throng
With whom my soul hath dwelt so long',
Let me, in that aspiring day,
Cast every lingering stain away',
And, panting for thy purer air',
Fly up' at once', and fix' me there'!—MOORE.

LESSON VIII.—SOFT-RAYED BONY FISHES, WITH ABDOMINAL VENTRAL FINS—*Continued.*

[Salmon and Trout, and Herring and Pilchard Families.]



SALMON AND TROUT FAMILY.—1. White-fish of the Lakes, *Coregonus albus*. 2. Common Sea Salmon, *Salmo salar*. 3. New York Brook Trout, *Salmo fontinalis*. 4. Troutlet. 5. Great Lake Trout of Europe, *Salmo ferox*.

1. OUR remaining notices of this order of the bony fishes embrace the Salmon and Trout, and the Herring and Pilchard families. Of all the fresh-water fishes of northern latitudes, those comprising the salmon and trout family are the most important in an economical point of view. To the naturalist, also, they are full of interest, as the history of many of them is chiefly curious; while with the angler many of the species are preferred to every other kind of fish as objects on which to exercise his skill.

2. The common sea salmon, which is the largest species of the family, is both a salt-water and a fresh-water fish. They invariably breed in fresh water, while they find their most nutritious food, and other conditions most favorable to their growth and general health, in salt water. They begin to enter rivers in spring, and continue ascending during the summer, but chiefly when the rivers are swollen by rains, when

they generally advance with some rapidity, often, it is supposed, at the rate of twenty-five miles a day.

3. So strong is the impulse that urges these fish on, that they overcome obstacles which, to an animal so formed, we would be inclined to pronounce insurmountable. They frequently make perpendicular leaps to the height of twelve or fourteen feet, thus surmounting waterfalls and other obstacles which the rocky bed of a river often presents to their progress. By the time they reach the upper and shallow portions of the river, these fish have assumed their most brilliant hues. Selecting some gravelly bottom, they then deposit their spawn, and cover it with a thin layer of sand.

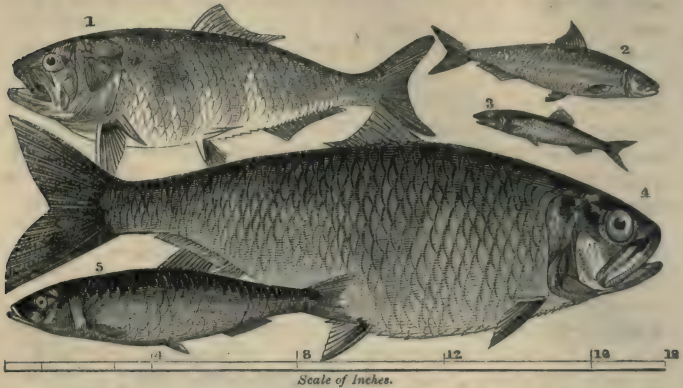
4. With this the parental duties of the fish cease; they lose their bright colors, become lean and emaciated, and, after reposing a while in the depths of some neighboring pool, they commence their progress down the river for the purpose of regaining the ocean, where they are speedily invigorated, and restored to their former condition. In England the spawning season is from October to the end of February; but the salmon which ascend the St. Lawrence appear in Lake Ontario in April, and leave it in October or November.

5. The eggs or spawn of the salmon continue under the sand where deposited, before hatching, in general from a hundred to a hundred and forty days. The first migration¹ of the young fish to the sea usually takes place late in the spring of their second year. They are then called salmon-smelts,* or samlets. On reaching the mouth of the river, they remain for a time where the water is brackish² by the mixture of salt-water, and, thus prepared for the change, they launch out into the sea, where they rapidly increase in size and vigor.

6. The common brook trout is so variable, both in color and markings, that scarcely two individuals from separate localities will answer to the same description. It is said that in England—and no doubt the same is true in this country—in lakes and rivers fed by dark waters from boggy moors, the tints become very deep, the back appearing almost black, and the sides and belly of an intense yellow, with the spots very large. The colors are believed to accommodate themselves to the tint of the water, and to the prevailing *tone* of the bottom, whether of rock or gravel, or softer substance; but, whatever may be the cause of this singular adaptation,

* The true *smelts* are a small fish of the Salmon family, five or six inches in length, but they are not the young of the salmon. They are taken in large quantities along our Atlantic coast from New Jersey to Labrador, and are often sold by measure.

there can be no doubt that it contributes to the concealment and safety of the fish, just as we often observe, in land animals, an assimilation of color to the places they frequent.



HERRING AND PILCHARD FAMILY.—1. The Mossbonker, or Hard-head, *Alosa menhaden* (very abundant on the shores of Long Island and Mass. It is seldom eaten). 2. The Pilchard, *Clupea pilchardus*. 3. The Anchovy, *Engraulis engrasicolus*. 4. American Shad, *Alosa preestabilis*. 5. The Herring, *Clupea harengus*.

7. The Herring and Pilchard family embraces several varieties of the herring, the pilchard, the common shad, and the anchovy of the Mediterranean. The common herring of the Atlantic, so well known as an article of food, is taken in vast quantities in drift nets, in the meshes of which it becomes entangled in attempting to pass through them. Formerly the herring were supposed to descend in a mighty army, early in the season, from the Arctic Seas, and then to divide and spread over the English coasts; but it is now believed that they winter in the deep water of the northern temperate regions, and only seek the shores and shallow portions of the ocean for the purpose of depositing their spawn.

8. The common American shad, which differs only in trifling particulars from what is known as the allice shad of Europe, is a beautiful and valuable fish, from one to two feet in length. It enters our rivers from the sea early in the season to deposit its spawn, and, unlike most of the family to which it belongs, comes from the southern instead of the northern seas. In the rivers of Georgia and the Carolinas it usually makes its appearance in January or February; in March it arrives at Norfolk; at New York, early in April; and on the coasts of New England still later. These fish ascend the Hud-

son one hundred and fifty miles to deposit their spawn, and descend in the latter part of May, when they are called *back shad*, and are then lean, and scarcely fit to be eaten. They were formerly taken in immense quantities, but their numbers are gradually diminishing.

9. The anchovy, which is a small fish from four to five inches in length, chiefly distinguished from the herrings by having the head pointed, the upper jaw the longest, and the mouth deeply divided, is abundant in the Mediterranean, and was well known to the Greeks and Romans, by whom the liquor prepared from it was held in high estimation. It is pickled in large quantities for exportation, and the well-known anchovy sauce, used for seasoning, is prepared from it.

¹ MĪ-GRĀ'-TION, removal.

| ² BRĀCK'-ISH, saltfish.

LES. IX.—SOFT-RAYED BONY FISHES, WITH THE VENTRAL FINS BENEATH THE PECTORALS: called *Sub-brachials*.

[The families of the Cod, Flat-fish, and Salt-water Suckers.]



THE COD FAMILY.—1. Three-bearded Rockling, or Sea-loche, *Motella tricirrata*. 2. The Torsk, *Brosimius vulgaris*. 3. The Haddock, *Morhua cælefinus*. 4. Coal-fish, *Merlangus carbonarius*. 5. The Ling, *Lota molva*. 6. Five-bearded Rockling, *Motella quinquecirrata*. 7. The Whiting, *Merlangus vulgaris*. 8. Great Forked Hake, *Phycis furcata*. 9. Common Cod, *Morhua vulgaris*.

THE second division of the soft-rayed bony fishes consists

of the Cod family, the family of the Flat-fish, and the two families of the salt-water Suckers.

1. THE COD FAMILY. (*Gadidæ*.)

1. At the head of the Cod family is the common cod, which is the largest, best known, and most valuable member of it. It is found universally in European Seas, from the coast of Spain to Iceland; and on the eastern American coast, and among its numerous islands, northward from the latitude of New York, it is even still more abundant. The Grand Banks of Newfoundland, reaching six hundred miles in length, seem to be literally covered with cod-fish, which are taken in vast quantities during the fishing season, which opens at the beginning of June, and lasts till about the middle of October. The cod are taken in deep water by hooks, usually baited with pork, sea-fowl, or shell-fish; and from two hundred to five hundred are often caught by one man in a single day. Notwithstanding the vast quantities taken—estimated at forty millions of fish annually—their numbers do not seem to diminish.

2. The haddock and the whiting, both fish of the Cod family, are almost as generally known as the common cod, and in Europe are considered nearly equal to the cod in value, but are not so highly esteemed in this country. The coal-fish, the ling, the rocklings, the torsk, and the great forked hake, are additional members of the same family, which we have represented in the engraving.

«A CHARADE' ON—*Cod*.

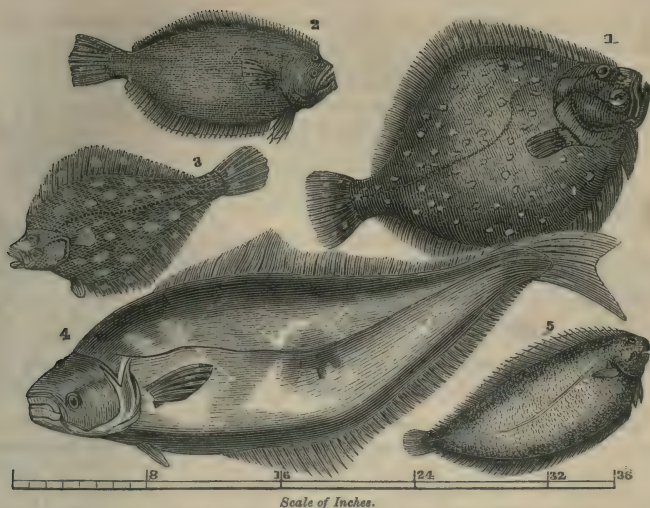
Cut off my head, and singular I act;
 Cut off my tail, and plural I appear;
 Cut off my tail and head—oh! wondrous fact,
 Although my middle's left, there's nothing here.
 What is my head cut off? a sounding sea.
 What is my tail cut off? a flowing river.
 Far in the ocean depths I fearless play;
 Giver of sweetest sounds, yet mute forever.

2. FAMILY OF THE FLAT-FISH. (*Pleuronectidæ*.)

“Flat-fish, with eyes distorted, square, ovoid, rhomboid, long,
 Some cased in mail, some slippery-back'd, the feeble and the strong.”

In one of Mr. Yarrell's volumes we find the following description of the flat-fish, the prominent species of which we have exhibited in the annexed engraving:

1. “The character and appearance of the various species of flat-fish are so peculiar as to claim particular notice. The want of symmetry in the form of the head; both eyes placed on the same side, one higher than the other, frequently not in the same vertical line, and often unequal in size; the position of the mouth; the inequality of the two sides of the head, and



FLAT-FISH FAMILY.—1. The Turbot, *Rhombus maximus*. 2. Oblong Flounder, *Platessa oblonga*. 3. The Plaice, *Platessa vulgaris* (similar in form to the *Rusty Dab* of our coasts). 4. The Halibut, *Hippoglossus vulgaris*. 5. Common Sole, *Solea vulgaris*.

the frequent want of uniformity in those fins that are in pairs, the pectoral and ventral fins of the under or white side being in some species smaller than those of the upper; and the whole of the color of the fish confined to one side, while the other side remains perfectly white, produce a grotesque² appearance; yet a little consideration will prove that these various and seemingly obvious anomalies³ are perfectly in harmony with that station in nature which an animal bearing these attributes⁴ is appointed to fill.

2. "As birds are seen to occupy very different stations, some obtaining their food on the ground, others on trees, and not a few at various degrees of elevation in the air, so are fishes destined to reside in different situations in the water: the flat-fishes and the various species of skate are, by their depressed form of body, admirably adapted to inhabit the lowest position, and where they occupy least space, among their kindred fishes.

3. "Preferring sandy or muddy shores, and unprovided with swimming bladders, their place is close to the ground, where, hiding their bodies horizontally in the loose soil at the bottom, with the head only slightly elevated, an eye on the under side of the head would be useless; but both eyes placed on the upper surface affords them an extensive range of view in those various directions in which they may either endeavor to find suitable food or avoid dangerous enemies. Having little or no means of defense, had their color been placed only above the lateral line on each side, in whatever position they moved their piebald⁵ appearance would have rendered them conspicuous objects to all their enemies.

4. "When near the ground they swim slowly, maintaining their horizontal position; and the smaller pectoral and ventral fins on the under side are advantageous where there is so much less room for their action, than with

the larger fins that are above. When suddenly disturbed they sometimes make a rapid shoot, changing their position from horizontal to vertical: if the observer happens to be opposite the white side, they may be seen to pass with the rapidity and flash of a meteor; but they soon sink down, resuming their previous motionless horizontal position, and are then distinguished with difficulty, owing to their great similarity in color to the surface on which they rest."

From another writer, Mr. Swainson, we quote the following remarks:

5. "The resemblance between the colors of the flat-fish, in general, and those of the ground they repose upon, is so admirably ordered as to claim both attention and admiration. The upper surface, or that which is exposed to view and to the action of the light, is invariably of some shade of earthen brown or of grayish sand-color: this is broken by dots and blotches, either light or dark, blackish or reddish, but always so disposed as perfectly to resemble those under shades, as they may be called, which are caused by the inequalities of the ground and the presence of particles of different tints that may be upon it.

6. "Thus, whether we contemplate the God of nature in his most sublime productions, or in those provisions which he makes for the well-being of his most irrational creatures, the same principle of design—the same absolute perfection in execution—is equally conspicuous. This exquisite finish is bestowed upon millions which the eye of man "hath not seen;" "nor hath it entered into his heart to conceive" the faculties and the instincts they possess, still less to form ideas on all the reasons of their creation. Such knowledge, indeed, we can not attain to in this stage of our existence, but the good shall most assuredly enjoy it in the next."

7. The European turbot, so well known, and so celebrated as an article of luxury, is considered the best of the flat-fishes. It has never been found on the coasts of the United States, although the spotted turbot, or New York plaice, much resembles it. The turbot is supposed to have been the *rhombus* of the Romans, of which a specimen of enormous size is said to have been taken in the reign of Domitian, who called a meeting of the senate to decide upon the best mode of bringing it to the table! Juvenal says:

"No vessel he finds to hold such a fish,
And the senate's convoked to decree a new dish."

¹ *CHA-RÂDE'* (*sha-râde'*), a word whose syl-

lables or letters are described, first sepa-

rately and then together, so as to form a

kind of riddle.

² *GRO-TÊSQUE'*, ludicrous; odd.

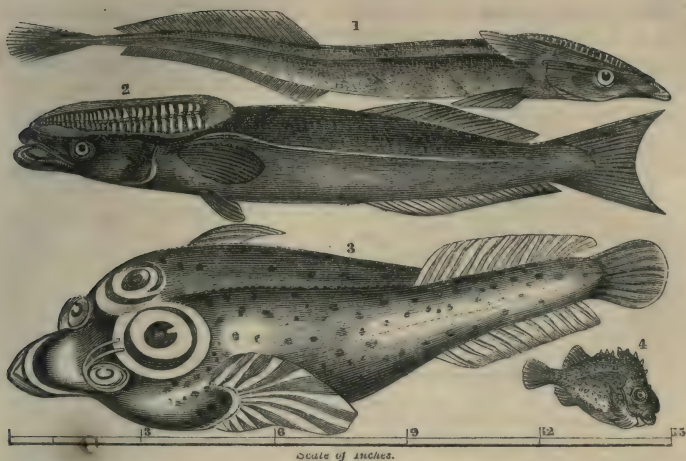
³ *A-NÔM'-A-LY*, irregularity.

⁴ *AT'-TRI-BUTE*, inherent quality; property.

⁵ *PÊ'-BALD*, of various colors.

3. THE SALT-WATER SUCKERS.

1. Of the fish known as the salt-water Suckers, there are two families. In the first the ventral fins, which are very much dilated beneath, are united around a circular disk, which acts as a sucker. By means of this instrument these fishes are able to attach themselves to any firm bodies in a



SALT-WATER SUCKERS.—1. White-tailed Remora, or Shark Sucker, *Echeneis albicauda*. 2. The Common Remora, or Sucking-fish, *Echeneis remora*. 3. Cornish Sucker, *Lepidogaster cornubiensis*. 4. Lump Sucker, *Cyclopterus lumpus*.

strong current of water, and thus to obtain food in places where most other fish would be swept away. The small Cornish sucker, found on the European coasts, and the common lump sucker, a beautifully colored fish found throughout all the Northern Seas, are the best known. Pennant relates that upon throwing a lump sucker into a pail of water, it adhered so firmly to the bottom that, upon taking hold of the fish by the tail, he lifted the whole vessel, although it held several gallons.

2. The few fishes which compose the second family of the Suckers are natives of Southern Seas, although a few species are occasional visitors of our American coasts. In this family the adhesive disk is placed on the crown of the head, in the form of a large oval shield, as may be seen in the famous remora of the Mediterranean, and the shark sucker, drawings of which we have given. The shark sucker is often found adhering to the shark, and is frequently met with in the vicinity of New York. The common rem'ora was familiar to the Greeks and Romans, from whom we have received many fabulous accounts of its extraordinary powers in attaching itself to the sides of ships, and arresting their course.

3. Even the naturalist Pliny asserts that it was this little fish which stayed the progress of Mark Antony's ship in the

naval engagement between him and Augustus Cæsar, and caused the defeat of the former; and that the Emperor Calig'ula once suffered a similar accident, which was the cause of his downfall! If naturalists could be thus easily imposed upon with respect to the marvelous powers of the remora, it is not surprising that this wonderful fish should have formed a theme for the wonder-loving poet:

"The sucking-fish beneath, with secret chains,
Clung to the keel, the swiftest ship detains.
The seamen run confused, no labor spared,
Let fly the sheets, and hoist the topmast yard.
The master bids them give her all the sails
To court the winds and catch the coming gales.
But though the canvas bellies to the blast,
And boisterous winds bear down the cracking mast,
The bark stands firmly rooted on the sea,
And will, unmoved, nor winds nor waves obey;
Still, as when calms have flatted all the plain,
And infant waves scarce wrinkle on the main."

LESSON X.—SOFT-RAYED BONY FISHES, DESTITUTE OF VENTRAL FINS: called *Apodals*.



THE EEL FAMILY.—1. Electric Gymnotus, *Gymnotus electricus*. 2. Conger Eel, *Conger vulgaris*. 3. The Muraena, *Muraena helena*. 4. American Sand-lance, *Ammodytes Americanus*. 5. Sharp-nosed Eel, *Anguilla acutirostris*.

1. THE third division of the soft-rayed bony fishes is com-

posed wholly of the Eel family. Yarrell, in his valuable work, thus speaks of this family of fishes:

"The form of the eel, resembling that of the serpent, has long excited a prejudice against it, which exists in some countries even to the present time; and its similarity to snakes has even been repeated by those who, from the advantages of education, and their acquirements in natural history, might have been supposed capable of drawing more accurate conclusions. There is but little similarity in the snake and the eel, except in the external form of the body: the important internal organs of the two animals, and the character of the skeleton, are most decidedly different.

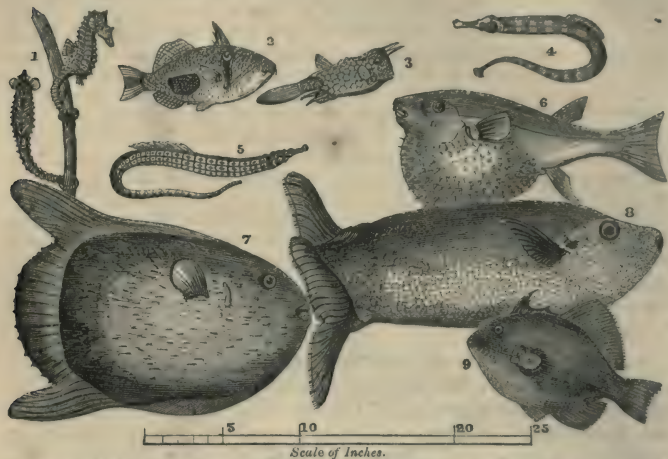
2. "Eels are, in reality, a valuable description of fish: their flesh is excellent food; they are very numerous, very prolific, and are found in almost every part of the world. The various species are hardy, tenacious of life, and very easily preserved." Ellis, in his *Polynesian Researches*, says: "In Otaheite, eels are great favorites, and are tamed and fed until they attain an enormous size. These pets are kept in large holes, two or three feet deep, partially filled with water. On the sides of these pits they generally remained, excepting when called by the person who fed them. I have been several times with the young chief when he has sat down by the hole, and, by giving a shrill sort of whistle, has brought out an enormous eel, which has moved about the surface of the water, and eaten with confidence out of its master's hand."

3. Some few eels are confined to fresh waters, and some wholly to the sea; but most of the species reside in the brackish water at the mouths of rivers. The *muraena*, an eel of the Mediterranean, was so highly prized by the Romans that they kept it in a tame state, and carefully fattened it for the table. Its colors and markings are extremely beautiful.

4. Plutarch tells us that Lucius Crassus brought up these fish almost by hand, and that they acknowledged his presence by springing out of the water whenever he came near: he was wont to deck them with rings and other ornaments; and another writer says that their loss was a greater grief to him than the death of his three children! In short, Cicero tells us that "many of the great men of Rome vied with each other in this extravagant fish passion, and deemed no moment of their lives more happy than when these creatures came to eat out of their hands."

5. But the most remarkable of the Eel family is the *gymno'tus*, or electrical eel of South America. It is sometimes five or six feet in length; it has no tail fin, and the scales are imperceptible to the naked eye. By its electric shocks it knocks down men and horses, and can be obtained only after its electric power has been expended by successive shocks. The Indians of Guiana, in South America, drive wild horses into the muddy ponds in which these eels abound, and thus are enabled to secure both horses and eels!

LES. XI.—SOFT-RAYED BONY FISHES WITH TUFTED GILLS:
Lophobranchii. SOFT-RAYED BONY FISHES WITH SOLDER-
 ED JAWS: *Plectognathii*.



1. Hudson River Sea-horse, *Hippocampus Hudsonius*. 2. Indian File-fish, *Balistes prasinoides*. 3. Horned Ostracion, *Ostracion cornutus*. 4. Great Pipe-fish, *Syngnathus acus*. 5. Aequorial Pipe-fish, or Needle-fish, *Acestra æquora*. 6. Pennant's Globe-fish, *Tetodon Pennantii*. 7. Short Sun-fish, or Head-fish, *Orthogoriscus mola*. 8. Oblong Sun-fish, *Orthogoriscus oblongus*. 9. European File-fish, *Balistes capriscus*.

1. THE remaining two divisions of the soft-rayed bony fishes, which are thus grouped in separate orders because they have certain peculiarities in the forms of their gills and the structure of their jaws, are embraced in the families of the Pipe fishes, the Balloon and Globe fishes, and a few armed fishes, mostly of tropical seas. In the drawing above are represented several species in each of these families. The pipe fishes, which vary from five or six inches to two feet in length, have a very remarkable appearance, the body being long and very slender, the snout also much lengthened, and the whole body covered with bony sculptured plates, like a coat of mail.

2. A remarkable peculiarity in several species of the pipe fishes is the existence, in the males, of two long and soft membranes which fold together, and form an abdominal pouch, in which the eggs are carried about until they are hatched, and into which the young retreat in case of danger. Fishermen assert that when the young are shaken out of the pouch into

the water, over the side of the boat, they do not swim away, but when the parent fish is held in the water in a favorable position, the young again enter the retreat which nature has provided for them. This provision for the care and safety of the young is strikingly similar to what is seen in marsupial quadrupeds. (*See Third Reader*, p. 236.)

3. A very singular species of the pipe fishes is the hippocampus, or, as it is frequently called in this country, the Hudson River sea-horse. It is five or six inches in length, the jaws are united and tubular, the shape of the head has considerable resemblance to that of the horse, the eyes move independently of each other, the body is covered with bony plates, and it is believed to be the only fish which has a prehensile¹ tail, showing in this latter particular an additional resemblance of the pipe fishes to the marsupial quadrupeds. When swimming about it maintains a vertical position; but the tail, ready to grasp whatever it meets in the water, quickly entwines in any direction around the weeds; and when the animal is thus fixed, it intently watches the surrounding objects, and darts at its prey with great dexterity.

4. The globe and balloon fishes, which belong to the fifth division of the soft-rayed bony fishes, are little less singular in appearance than those of the fourth division. The globe-fishes, or puffers, possess the peculiar property of puffing themselves up into a globular form by swallowing a quantity of air. When thus inflated,² in consequence of the under parts becoming lighter than the upper, the fish turns upside down, and floats about in this condition, still retaining the power of directing its course. As the inflated abdomen is covered with spines, this seems to be a means of warding off the attack of enemies.

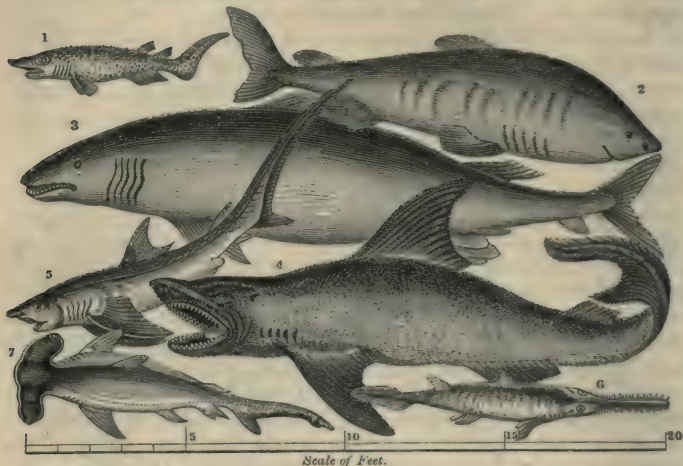
5. The short and the oblong sun fishes appear as though portions had been cut away, so as to leave little but the head remaining. Among the armed fishes of this order, the European file-fish is the best known. It is so named because it has the first and strongest spine of the back studded up the front with small projections. In the same family is the balistes of the Indian Seas, which is armed near the tail with three rows of crooked spines; also the horned ostracion, a strange-looking fish, which has two horns extending from the head in front, and two near the ventral fins.

¹ PRE-HĒN'-sĪLE, grasping; adapted to seize, | ² IN-FLĀ'-TED, puffed up, or swollen by air.
as the tail of a monkey.

THIRD CLASS OF FISHES.

CARTILAGINOUS FISHES. (*Chondropterygii*.)

[Shark, Sturgeon, Chimæra, Ray, and Lamprey Families.]



THE SHARK FAMILY.—1. Spinous Shark, *Echinoclinus spinosus*. 2. Greenland Shark, *Scymnus borealis*. 3. Basking Shark, *Selachus maximus*. 4. White Shark, *Charcharias vulgaris*. 5. Fox Shark, or Thresher, *Alopias vulpes*. 6. Cirrated Saw-fish, *Pristis cirratitis*. 7. Hammer-headed Shark, *Zygæna malleus*.

LESSON XII.—THE SHARK FAMILY. (PLACOIDS.)

1. No life is in the air, but in the waters
Are creatures huge, and terrible, and strong;
The sword-fish and the shark pursue their slaughters,
War universal reigns these depths along.
Like some new island on the ocean springing,
Floats on the surface some gigantic whale,
From its vast head a silver fountain flinging,
Bright as the fountain in a fairy tale.—L. E. MACLEAN.

2. Although the cartilaginous¹ division is of very limited extent, compared with either of the preceding, yet the most formidable of the whole class of fishes are embraced in it. As their name implies, their skeleton consists of cartilage instead of bone; and it is probably owing to the comparatively soft texture of the skeleton that these fish continue to grow as long as they live. The consequence is that, as they mostly inhabit the wide ocean, and have few enemies, they are sometimes met with of a size so enormous that their weight and dimensions are almost incredible.

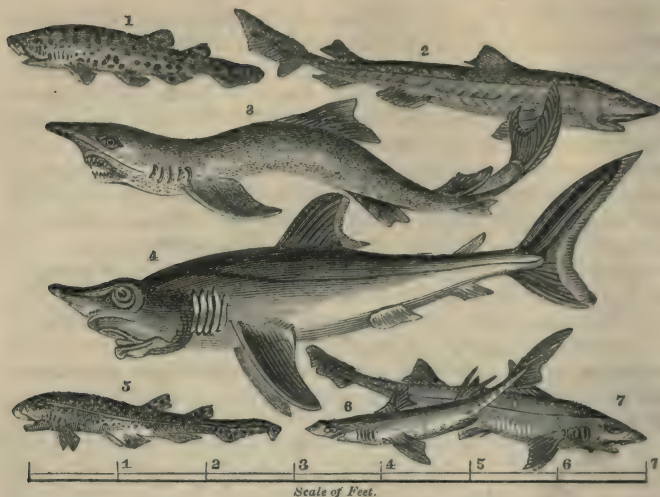
3. The sharks, which are the most conspicuous and the most perfectly organized of the cartilaginous division, are among fishes what the carnivorous² animals are among quadrupeds, and the eagles, hawks, and owls among birds. Like these their representatives, they are proverbially³ the tigers and panthers of the ocean; and they frequently carry upon them, as it were, the very spots and markings of those ferocious beasts. Their forms are often gigantic, and their fierceness and voracity proverbial: they are the dread and detestation of mariners; and, even when dead, their aspect is sufficient to excite fear. These monsters of the deep are nearly all completely carnivorous; and their appetite is so voracious that they indiscriminately devour whatever living being comes in their way. It is a well-authenticated fact that some of these monsters, at a single bite, have cut a man in two; and an entire human body is said to have been found, on one occasion, in the stomach of one of them.

4. Fortunately, however, very few of the sharks found in our temperate latitudes grow to such a size as to awaken our fears, or commit injury upon our persons; but, as soon as we enter the warmer regions, toward the tropics, bathing in the sea becomes a hazardous, and often dangerous undertaking. In tropical climes the ocean swarms with sharks. They all swim with great velocity, and often in vast multitudes, especially when pursuing shoals of other fish.

5. The sharks have a hard, rough, leathery skin, sometimes covered with small warts intermingled with spines;* but none have yet been found with true scales. The skin, when dried, forms an article of commerce, and is used for polishing wood; also as a covering for boxes, watch-cases, etc., under the name of shagreen. The mouth of the shark is concealed beneath an extended snout; and it is owing to this position that the fish is compelled to turn nearly on its back when it seizes its prey.

6. Among the larger and more formidable of the sharks are the white shark, the basking shark, the fox shark or thresher, and the Greenland shark. The white shark is seldom seen on our coasts, but is abundant in the Mediterranean, and is found in great numbers in tropical climates. It is often thirty feet in length, and swims with great swiftness. It scents its prey at a great distance, and it is affirmed that it is much more apt to attack a negro than a white man; and when both

* It is the character of this warty or spiny covering that places the sharks in Agassiz's division of *Placoid* fishes.



THE SHARKS, continued.—1. Large-spotted Dog-fish, *Scyllium catulus*. 2. Tope, or Penny-dog, *Galeus vulgaris*. 3. Blue Shark (the most common shark on our coasts), *Carcharias glaucus*. 4. Porbeagle, *Lamna cornubica*. 5. Small-spotted Dog-fish, *Scyllium canicula*. 6. Picked (or Piked) Dog-fish, *Acanthias vulgaris*. 7. Smooth Hound, *Mustelus lævis*.

are bathing together, or otherwise in its power, it generally selects the former. Cuvier thus speaks of this shark:

7. "The French name this terrible animal *Requin*, or *Requiem*, 'the rest or stillness of death,' in allusion to the deadly character of its habits; and when we consider its enormous size and powers, the strength and number of its teeth, the rapidity of its movements, its frequent appearance during all the turmoil and horrors of a tempest, with death and destruction apparent in every blast and every wave, to add to the horror of the scene by the phosphoric light emitted from its huge body near the surface of the troubled waters, with its open mouth and throat ready to swallow, entire, the despairing sailor, we must admit the propriety of a name expressive of the natural association of ideas which connects this cruel monster of the deep with death."

8. The spinous shark, equally frightful in appearance, but much smaller than the white shark, is covered with spines which exactly resemble the prickles from the stem of a rose-bush. The basking shark, so called from its habit of remaining occasionally at the surface of the water almost motionless, as if enjoying the influence of the sun's rays, has been known to measure thirty-six feet in length. This species has the smallest teeth, in proportion to its size, of any of the sharks, and is not a ravenous^d fish. It is often so indifferent to the

approach of a boat as to suffer it even to touch its body when listlessly sunning itself on the surface; but if deeply struck with a harpoon, it plunges suddenly down, and swims away with such rapidity and violence as to become a difficult as well as a dangerous capture. It is supposed that this huge fish, swimming near the surface, with its upper jaw projected out of the water, has often been mistaken for the sea-serpent.

9. The thresher, or fox shark, which is not so uncommon on our coasts, has received its name from its habit of attacking other animals, or defending itself by blows of the tail. In company with the sword-fish it often attacks the whale, as we have before described. (See p. 236.) It has been observed to approach a herd of dolphins sporting in security on the surface, and by one splash of its formidable weapon to scatter them in alarm in every direction. The Greenland shark, which is found only in northern seas, and is another of the foes of the whale, has thus been described by Scoresby:

10. "It bites the whale, and annoys it while living, and feeds on it when dead. It scoops pieces out of its body nearly as big as a man's head; and continues scooping and gorging, lump after lump, until the whole cavity of its belly is filled. It is so insensible to pain that it has been run through the body with a knife, and escaped, yet after a while it has been seen to return and banquet on the whale at the very spot where it had received its wounds.

11. "The heart of this shark is very small; it performs six or eight pulsations in a minute, and continues its beating for some time after it is taken out of the body. The body also, though separated into several parts, gives evidence of life for a similar length of time. It is therefore exceedingly difficult to kill this fish; and it is actually unsafe to thrust the hand into its mouth, though the head be separated from the body. Though the whale-fishers frequently slip into the water where these sharks abound, it is not known that they have ever been attacked by them. Indeed, the sailors imagine that this fish is blind, because it pays not the least attention to the presence of a man; and it is so stupid that it never draws back when a blow is aimed at it with a knife or lance."

12. The most curious of all the sharks is that which is popularly termed by fishermen the shovel-nose, or hammer-head. It has a head three times broader than long, is from four to ten feet in length, and has been several times taken in New York harbor. The mouth, being on the under side, can not be seen in the drawing which we have given. The saw-fish, which is usually included in the Shark family, has its upper jaw prolonged into a bony snout, often five or six feet in length, and having its sides covered with numerous sharp spines similar to teeth.

¹ ĊĀR-TĪ'-LĀĠ'-IN-ŌUS, having the qualities of cartilage or gristle.

² ĊĀR-NĪV'-O-ROUS, feeding on flesh.

³ PRO-VĒRB'-I-AL-LY, speaking in the form of a proverb or by-word.

⁴ RĀV'-EN-ŌUS, hungry for prey; voracious.

LESSON XIII.—CARTILAGINOUS FISHES CONTINUED.

[Sturgeon, Chimæra, Ray, and Lamprey Families.]



STURGEON AND CHIMÆRA FAMILIES.—1. Common Sturgeon of the Atlantic, *Acipenser sturio*. 2. Northern Chimæra, *Chimæra monstrosa*. 3. American Lake Sturgeon, *Acipenser rubicundus*.

1. Of the Sturgeon family, the best known are the common sturgeon of the Atlantic, usually found in rivers which flow into the sea, and the fresh-water sturgeon found in the large lakes of North America. The fish of this family, like the sharks, are at once known by their long and angular body, which is defended by rows of large bony plates of a pyramidal form, with the apex pointed. In England and France the sturgeon was formerly regarded as a royal fish—that is, the property of the crown. The flesh is firm and compact, tasting somewhat like veal. The sturgeon seeks its food chiefly at the bottom of rivers, plowing up the mud with its long snout as a hog does the ground. It often does much damage by getting entangled in the nets of the fishermen, but is otherwise harmless.

2. The chimæras, or sea-monsters, which are rare fish, are remarkable for the singularity of their appearance, which gives as much the idea of a reptile as of a fish. The rays, or skates, which are still more remarkable in appearance, may be considered the flat fishes of the cartilaginous order. With few exceptions they are wholly marine fishes. Most of them have the pectoral fins so largely developed that they extend entirely around the head and body, to which they give a disk-like form; the tail is slender, and the dorsal fins, when present, are generally remarkably small, and placed far back on the body.

3. The eyes of the rays are placed on the upper surface;

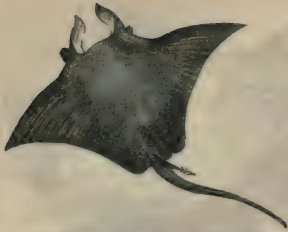


THE RAY FAMILY.—1. Common Torpedo, *Torpedo vulgaris*. 2. Many-spined Trygon, *Trygon histrix*. 3. Thornback Ray, *Raia clavata*. 4. Angel-fish, or Monk-fish, *Aquatina angelus*. 5. Eagle Ray, or Whip Ray, *Myliobatis aquila*.

but the mouth, nostrils, and branchial openings—the latter usually five in number, and arranged like those of the sharks—are on the under surface. The tail is usually covered with rows of spines, and in several species is additionally armed with a hard bony weapon in the shape of a long-headed lance. It is supposed that this weapon falls off at certain intervals—perhaps annually, to be replaced by another. The South Sea Islanders sometimes use it as a point to their arrows and spears; and the natives of Guiana are said to use the barbs of the fresh-water species of that country for the same purpose.

4. Although most of the members of the Ray and Skate family are only from one to three and four feet in length, yet some species, especially those of the horned or banksian ray, which are more familiarly known to sailors as sea devils or ocean vampires, attain to enormous dimensions. In the horned ray, the pectoral fins, instead of entirely embracing the head, are each prolonged considerably in front, so as to present the appearance of two horns; and the eyes are inserted on the circumference, not within it.

5. This fish, which usually lies concealed at the bottom of the sea, is said to have been found of such weight that seven yoke of oxen were required to draw it ashore. Voyagers report having seen it thirty or forty feet in length. Colonel



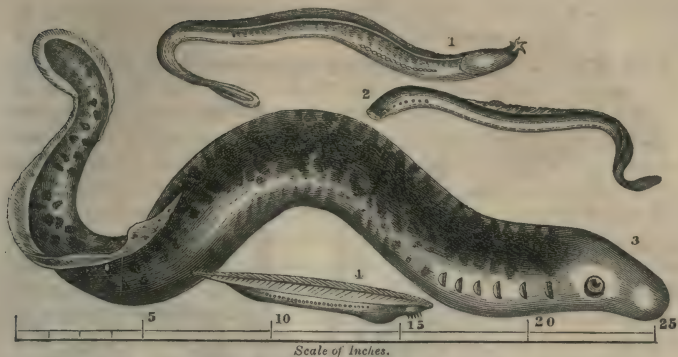
Horned Ray, Sea Devil, or Ocean Vampire, *Cephaloptera vampirus*.

Hamilton Smith relates that he once witnessed the destruction of a soldier by one of these immense rays, off the island of Trinidad. It appears that the soldier wished to desert, and, being a good swimmer, he had jumped into the sea from the vessel, which then lay at anchor near the entrance of the harbor. The circumstance occurred soon after daylight, and the man, being alarmed by the call of a sailor up aloft, endeavored to return to the ship; but the monster fish threw one of his fins over him, and he was never seen more.

6. In the Natural History of the State of New York we find it stated that this fish has been known "to seize the cable of a small vessel at anchor, and draw the vessel several miles with great velocity." The writer, Mr. De Kay, says: "An instance of this kind was related to me by a credible witness, as having occurred in the harbor of Charleston. A schooner lying at anchor was suddenly seen moving across the harbor with great rapidity, impelled by some unknown and mysterious power. Upon approaching the opposite shore, its course was changed so suddenly as nearly to capsize the vessel, when it again crossed the harbor with its former velocity, and the same scene was repeated when it reached the shore. These mysterious flights across the harbor were repeated several times, in the presence of hundreds of spectators." If this be a true fish story, even the Atlantic cable may have been torn from its moorings by some of these monsters of the deep.

7. Among the rays are a group of fish which possess electrical properties, and which are known as electric rays, or torpedoes. Although the torpedo is less powerfully electrical than the gymnotus or eel, it can benumb the arm of a person touching it; and this power it seems to exert at will, both as a means of defense and for the purpose of securing its prey. The angel-fish, or shark-ray, of which we have given a drawing, is classed by some among the sharks. It is more remarkable for the singularity of its form than for its beauty.

8. There is still another family of fishes of the cartilaginous division called Lampreys, resembling the eels in form. We have given drawings of several species. The sea-lamprey is esteemed by many as a delicious article of food. The lampreys occupy the lowest place, not only among fishes, but



THE LAMPREY FAMILY.—1. Glutinous Hag, or Myxine, *Gastrobranchus cæcus*. 2. The Pride, or Mud Lamprey, *Ammocetes branchialis*. 3. Common Lamprey, *Pteromyzon marinus*. 4. The Lancelot, *Amphioxus lanceolatus*.

among all vertebrated animals, showing the gradual approaches which one class of animals makes to another. Thus one species, the glutinous hag, is destitute of eyes. The lancelet, which has been classed among the lampreys, is the lowest link yet discovered in the scale of vertebrated life, as the skeleton is only a series of sacs, and there is a total want of brain, eye, and ear.

Here we close our description of the four great classes of vertebrate animals—mammalia, birds, reptiles, and fishes. In the sixth volume of this series we enter upon another great division of zoology—the Insect World—in which we shall find renewed evidence of that wisdom which has peopled every part of our globe with life adapted to the conditions for which it is destined. When we shall have arrived at those lowest links in the scale of animal life which connect the animal and vegetable kingdoms, we shall look with renewed interest upon the great whole of animated nature; and as we trace upward, from the dividing line, a gradual elevation, until we arrive at the most intelligent of the brute animals, and there find the chain suddenly broken, we shall more fully realize the beauty of the Christian idea, that *man* belongs to an entirely different and immeasurably higher order of being, although perhaps the lowest in a series that rises upward—upward—through angelic hosts, until it takes hold of the throne of the ETERNAL.

LES. XIV.—THE AQUARIA, OR DRAWING-ROOM FISH-PONDS.



1. DECIDEDLY the prettiest drawing-room ornament that has been invented of late years is the *Aquarium*, or ornamental fish-pond. This is usually a glass vessel, either circular or oblong, with a slate bottom, wooden or zinc pillars, and glass sides, and containing various kinds of sea-weed, fish, and marine animals of the lower organizations, all in the full vigor of life.

2. It is hard to say whether the process by which the present *aquaria* were developed, or that development itself, is the

more wonderful. Probably every body has seen gold-fish in the old conventional¹ glass tureen.² Their life was a series of spirals, and it was a relief to beholders as well as to themselves when they expired at last. Dazzled by the glare of the sunlight through the sides of their glass dwelling, the poor creatures spent their whole existence in trying to find out where they were and how they could get out: no moth near a candle ever suffered more agonizing perplexity than they. To keep them in some appearance of health for a few weeks, it was necessary to change the water frequently: every time this was done the poor little creatures died a thousand deaths—endured such agony as we should feel if we were plunged to the bottom of a river, and held there till we were senseless, every morning before breakfast.

3. It was found a difficult matter to rear, in this way, the hardy gold-fish, while almost every other description of fish would have perished in the glass tureen within a week. And for this simple reason: like all living creatures, fish emit carbonic acid gas; this, in a confined body of water, would soon be in excess, the water would become poisonous, and the fish would die. The only alternative—that of changing the water daily—would frequently be fatal to the tender creatures that were compelled to submit to our handling.

4. At length, however—and it was only a few years ago—the principle was discovered that, in water as in air, the prime function of plants is to evolve oxygen and to consume carbonic acid gas; in other words, to use for food the noxious vapor emitted by animals, and to supply them, in its stead, with the first necessary of animal life—pure air.

5. Starting with this principle, about the year 1850, a Mr. Warrington, an Englishman, set about breeding fish and mollusks³ in tanks, with the aid of marine plants. He succeeded admirably for a few days; but, after a time, a change came o'er his little worlds. Without apparent reason the water became suddenly impure, and his fish died. Here was a new agency at work. With the aid of the microscope, Mr. Warrington explored his tank for the poison which was evidently latent⁴ there. He soon discovered that some of his plants had reached maturity, and, obedient to the law of nature, had died and decayed. The decaying matter was the poison he was in search of. How was this to be counteracted?

6. In Nature's tanks, reflected Mr. Warrington—in seas, rivers, and ponds—plants must die and decay, yet the decay does not destroy animal life. We must see how Nature obviates

the evil. The experimentalist hastened to a pond in the vicinity, and explored its bottom with care. He found, as he had anticipated, abundance of decayed vegetable matter; but he likewise found swarms of water-snails doing duty as scavengers,⁵ and devouring the putrefying substances before they had time to taint the water. Here was the secret—so beautiful a contrivance that it is said Mr. Warrington, with the emotion of a true man of science, burst into tears when it flashed upon him.

7. He dried his eyes, however, quickly enough, pocketed some snails, and threw a handful of them into his little tank at home. In a single day the water was pure and clear. Fish launched into it thrived and gamboled, grew and multiplied; the plants resumed their bright colors, and the snails not only rollicked⁶ in an abundance of decaying branches from the plants, but laid a profusion of eggs, on which the fish and mollusks dined sumptuously every day.

8. Thus the *aquarium*—the drawing-room fish-pond—became a possibility. Mr. Warrington communicated his discoveries to the Royal Society of London; they were taken up by half the scientific men of England, and a series of experiments was begun, to test the relative capacity of the various known kinds of marine plants, fish, and marine creatures of the lowest orders, for living in the limited area of a house-tank. Those experiments have been so thorough that books are now published containing the most minute directions for the establishment of aquaria; and it is said that almost every great drawing-room in England is provided with one or more of them.

9. The most common kind of aquarium is the oblong box or the circular vase, like the one represented in the engraving. If all the sides are of glass, that which is nearest the light should be shaded with a curtain, as neither fish nor plants thrive unless the sunlight reaches them from the surface of the water. Nature must always be copied. If you would have fish in your aquarium, a siphon⁷ should be used to change the water occasionally, and a syringe to aerate⁸ it daily, unless a gentle stream can be made to flow in and out constantly. Perfectly still water is too slow for well-bred fish, although it may do for reptiles.

10. Having provided yourself with the aquarium, strew the bottom with clean sand and fine pebbles to the depth of some three inches; then build your rock-work. As trees were created before the creatures which bask in their shade, so you

must plant your marine vegetation before you people your miniature ocean. Having therefore poured in your water, which should be as fresh as possible from its source, and not on any account boiled, introduce your plants, taking care that each is not only perfect as to its root, but is also supplied with some portion of its maternal mould or rock.

11. It is believed that most marine plants, and all the seaweeds, will thrive in the salt-water aquaria. Zoophytes,⁹ or animal plants, must find a place there; and among these, those wonderful creatures, the star-fish, which possess the power of cutting themselves up into joints, and dissolving into six or eight perfect creatures of their own species. Mollusks³ and crustaceans¹⁰ must be added, to act the part of scavengers and street inspectors. Among the mollusks are several species of whelk, which are found useful as window-washers, that is, in keeping the glass sides of the tank clear and bright. As to fish, we may select, from a great variety, the flounders (when young), the sticklebacks, the mullets, the gobies and blennies, the porgee, the pipe-fish, and many others. The sticklebacks—which build nests, and behave themselves in so unfishlike a manner generally—are great favorites.

12. Thus far of salt-water ponds. But aquaria may be filled with fresh water, and supplied with fresh-water plants and animals on precisely the same principles. Here snails and muscles are a necessity, to consume the decaying vegetation; and there is no limit to the fish which may be introduced, among which we would mention gold and silver fish, perch, carp, pike, trout, eels, and minnows. It is recommended, however, that the pike be small of his kind, or the other fish will unaccountably disappear. Newts and lizards may also be introduced. They are very pretty indeed, as they disport themselves in a bright aquarium, or sun themselves on the rocky island which you have built for their benefit. Let every family which can, and every school, have its aquarium. It will afford amusement and instruction to all.

¹ CON-VĒN'-TION-AL, customary.

² TU-RĒEN', a vessel for holding soup.

³ MOL-LŪSKS', animals whose bodies are soft and not jointed, but which generally have a hard or shelly covering. (See Seventh Reader.)

⁴ LĀ'-TENT, not visible; hidden.

⁵ SĀV'-KN-ĜERS, street-cleaners.

⁶ RĪL'-LICKED, moved about in a frolicsome manner.

⁷ SĪ'-PHON, see page 347.

⁸ Ā'-ER-ĀTE, to purify by admitting the air.

⁹ ZŪ'-O-PHYTE, an animal plant, like the sponge and coral.

¹⁰ CRUS-TĀ'-OE-AN (-shean), animals like lobsters, crabs, etc. (See Seventh Reader.)

FIFTH MISCELLANEOUS DIVISION.



LESSON I.—THE GLORY OF THE IMAGINATION.

1. THE shepherd-lad, that in the sunshine carves,
On the green turf, a dial—to divide
The silent hours'; and who to that report
Can portion out his pleasures, and adapt,
Throughout a long and lonely summer's day,
His round of pastoral duties', is not left
With less intelligence for *moral* things
Of gravest import. Early he perceives
Within himself a measure and a rule,
Which to the sun of truth he can apply',
That shines for him', and shines for all mankind.'
2. Experience daily fixing his regards
On Nature's wants, he knows how few' they are',
And where they lie', how answer'd' and appeased':
This knowledge ample recompense affords
For manifold privations'; he refers
His notions to this standard'; on this rock
Rests his desires'; and hence, in after life',
Soul-strengthening patience and sublime content.
3. Imagination—not permitted here
To waste her powers, as in the worldling's mind,
On fickle pleasures, and superfluous cares,

And trivial ostentation'—is left free
 And puissant to range the solemn walks
 Of time and nature', girded by a zone
 That, while it binds', invigorates and supports.'

4. Acknowledge, then, that whether by the side
 Of his poor hut', or on the mountain-top',
 Or in the cultur'd field', a man so bred
 (Take from him what you will upon the score
 Of ignorance or illusion) lives and breathes
 For noble purposes of mind': his heart
 Beats to th' heroic song of ancient days';
 His eye distinguishes', his soul creates'.—WORDSWORTH.

LES. II.—SHYLOCK: A SCENE OF CONTENDING PASSIONS.

1. THE following is taken from Shakspeare's play of the Merchant of Venice. The daughter of Shylock, a rich and covetous Jew, had eloped with Lorenzo and gone to Genoa, taking with her some of her father's costly jewels; and Tubal, the agent of the Jew, has just returned from a fruitless search after the runaways. The absence of his daughter distresses the Jew, but the loss of his jewels still more; yet his grief is repeatedly assuaged and changed to the highest exultation, as Tubal mentions the misfortunes which had befallen the merchant Antonio, to whom the Jew had lent money on a bond, and to whom he owes a mortal grudge.

The contending passions of the Jew are admirably portrayed here, and the same should be truthfully expressed in the reading.

Shylock. How now', Tubal', what news from Genoa'? Hast thou found my daughter'?

Tubal. I often came where I did hear of her, but can not find her.

Shy. Why there, there, there, there! a diamond gone, cost me two thousand ducats in Frankfort! The curse never fell upon our nation till now; I never felt it till now: two thousand ducats in that; and other precious, precious jewels.—I would my daughter were dead at my foot, and the jewels in her ear! Would she were hearsed at my foot, and the ducats in her coffin! No news of them'?—Why, so;—and I know not what's spent in the search. Why thou loss upon loss! the thief gone with so much', and so much to find the thief'; and no satisfaction', no revenge'; nor no ill luck stirring but what lights o' my' shoulders; no sighs' but o' my' breathing; no tears' but o' my' shedding.^a

Tub. Yes, other men have ill luck too: Antonio, as I heard in Genoa—

Shy. What, what, what'? ill luck, ill luck'?^b

Tub. Hath an argosy cast away, coming from Tripolis.

Shy. I thank God, I thank God!—Is it true'? is it true'?^b

^a This is spoken in a tone of sobbing grief.

^b Spoken rapidly. Shylock catches, with eager joy, at the news of Antonio's ill luck.

Tub. I spoke with some of the sailors that escaped the wreck.

Shy. I thank thee, good Tubal:—Good news, good news; ha! ha!—Where? in Genoa?^b

Tub. Your daughter spent in Genoa, as I heard, one night, fourscore ducats.

Shy. Thou stick'st a dagger¹ in me;—I shall never see my gold again. Fourscore ducats at a sitting¹! fourscore ducats!^c

Tub. There came divers of Antonio's creditors in my company to Venice, that swear he can not choose but break.

Shy. I am very glad of it; I'll plague him; I'll torture him; I am glad of it.^b

Tub. One of them showed me a ring that he had of your daughter for a monkey.

Shy. Out upon her! Thou torturest me, Tubal: it was my turquoise; I had it of Leah, when I was a bachelor. I would not have given it for a wilderness¹ of monkeys.

Tub. But Antonio is certainly undone.

Shy. Nay, that's true, that's very true. Go, Tubal, fee me an officer; bespeak him a fortnight before. I will have the heart of him, if he forfeit; for, were he out of Venice, I can make what merchandise I will. Go, go, Tubal, and meet me at our synagogue; go, good Tubal; at our synagogue, Tubal.

LES. III.—SHYLOCK AND THE MERCHANT: THE TRIAL SCENE.

1. THE following is partially explained in the preceding lesson. The merchant Antonio had borrowed from Shylock, for his friend Bassanio, the sum of three thousand ducats; and Shylock had caused to be inserted in the bond the condition that, if Antonio should fail to make payment on a *certain day*, the merchant should forfeit a *pound of flesh*, to be cut off nearest his heart. Owing to losses, Antonio was unable to pay on the day appointed; and although afterward his friends offered to make double, treble, or quadruple payment to the Jew, the latter claimed, as he had a right to by the strict "law of Venice," *exact* fulfillment of the *bond*.

2. In the following scene the parties appear in court before the Duke of Venice; and Portia, the wife of Bassanio, a lady of high mental powers and great goodness, the heiress of a princely name and countless wealth, but here so disguised, as a learned doctor and judge from Padua, as to be unrecognized even by her own husband, is introduced, to counsel with the duke in the administration of justice.

Although the *Jew* is here placed in a very odious light, it ought not to be regarded as any imputation upon the *sect* to which he belongs.

^c Very mournfully and slowly, but emphatically: the downward inflection.

Duke. Give me your hand'. Came you from old Bellario'?

Portia. I did, my lord.

Duke. You are welcome': take your place.

Are you acquainted with the difference

That holds this present question in the court'?

Por. I am informed thoroughly of the cause.

Which is the merchant' here, and which the Jew'?

Duke. Antonio and old Shylock', both stand forth'.

Por. Is your name Shylock'?

Shylock. Shylock is my name.

Por. Of a strange nature is the suit you follow;

Yet in such rule, that the Venetian law

Can not impugn you as you do proceed.

You stand within his danger', do you not'?

(*To Antonio.*)

Antonio. Ay, so he says.

Por. Do you confess the bond'?

Ant. I do.

Por. Then must the Jew be merciful.

Shy. On what *compulsion*' must I'? tell' me that'.

Por. The quality of mercy is not strained';

It droppeth as the gentle rain from heaven

Upon the place beneath'; it is twice' blessed;

It blesseth him that gives', and him that takes'.

'Tis mightiest in the mightiest'. It becomes

The throned monarch better than his crown':

His *sceptre* shows the force of *temporal* power,

The attribute to awe and majesty,

Wherein doth sit the dread and fear of kings':

But *mercy* is above this sceptred sway';

It is enthroned in the hearts of kings';

It is an attribute to God himself';

And earthly power doth then show likest God's

When mercy seasons justice. Therefore', Jew',

Though justice be thy plea, consider this—

That, in the course of justice, none of us

Should see salvation': we do *pray*' for mercy;

And that same prayer doth teach us all to render

The deeds' of mercy. I have spoke thus much

To mitigate the justice of thy plea;

Which if thou follow, this strict court of Venice

Must needs give sentence 'gainst the merchant there.

Shy. My deeds upon my head'! I crave the *law*',

The penalty and forfeit of my *bond*'.

Por. Is he not able to discharge the money'?

Bassanio. Yes, here I tender it for him in the court;

Yea, *twice*' the sum; if that will not suffice,

I will be bound to pay it ten times o'er,

On forfeit of my hands, my head, my heart:

If this will not suffice, it must appear

That malice bears down truth. And I beseech you,

Wrest once the law to your authority:

To do a *great right*, do a *little wrong*,

And curb this cruel devil of his will.

Por. It must not be¹; there's no power in Venice
Can alter a decree established¹;
'Twill be recorded for a precedent¹;
And many an error, by the same example,
Will rush into the state: it can not be.

Shy. A Daniel come to judgment! Yea, a Daniel!
O wise young judge, how do I honor thee!

Por. I pray you, let me look upon the bond.

Shy. Here 'tis, most reverend doctor; here it is.

Por. Shylock, there's thrice thy money offered thee.

Shy. An oath, an oath, I have an *oath* in heaven:
Shall I lay perjury upon my soul?
No¹, not for Venice¹.

Por. Why, this bond is forfeit;
And lawfully by this the Jew may claim¹
A pound of flesh, to be by him cut off
Nearest the merchant's heart. Be *mer¹ciful*;
Take *thrice¹* thy money; bid me *tear¹* the bond.

Shy. When it is paid according to the tenor.
It doth appear, you are a *worthy¹* judge;
You know the *law¹*; your exposition
Hath been most sound. I charge you by the law,
Whereof you are a well-deserving pillar,
Proceed to judgment: by my soul I swear,
There is no power in the tongue of man
To alter me. I stay here on my *band¹*.

Ant. Most heartily do I beseech the court
To give the judgment.

Por. Why, then, thus it is:
You must prepare your bosom for his knife.

Shy. O noble judge¹! O excellent young man¹!

Por. For the intent and purpose of the law
Hath full relation to the penalty,
Which here appeareth due upon the bond.

Shy. 'Tis very true: O wise and upright judge!
How much more elder art thou than thy looks!

Por. Therefore, lay bare your bosom.

Shy. Ay, his breast;

So says the bond—doth it not, noble judge?¹—
Nearest his heart; those are the very words.

Por. It is so. Are there balance here, to weigh
The flesh?

Shy. I have them ready.

Por. Have by some surgeon, Shylock, on your charge,
To stop his wounds, lest he do bleed to death.

Shy. Is it so nominated in the bond?

Por. It is not so expressed; but what of that?
'Twere good you do so much for *charity*.

Shy. I can not find it; 'tis not in the bond.

Por. Come, merchant, have you any thing to say?

Ant. But little; I am armed, and well prepared.

Give me your hand¹, Bassanio¹! fare you well!
Grieve not that I am fallen to this for you;

For herein fortune shows herself more kind
 Than is her custom: it is still her use,
 To let the wretched man outlive his wealth';
 To view, with hollow eye and wrinkled brow,
 An age of poverty'; from which lingering penance
 Of such misery doth she cut me off.

Commend me to your honorable wife':
 Tell her the process of Antonio's end';
 Say, how I loved' you; speak me fair in death;
 And, when the tale is told', bid her be judge,
 Whether Bassanio had not once a love.
 Repent not you that you shall lose your friend';
 And he repents not that he pays your debt';
 For, if the Jew do cut but deep enough',
 I'll pay it instantly with all my heart.

Por. A pound of that same merchant's flesh is thine;
 The court awards it', and the law doth give' it.

Shy. Most rightful judge!

Por. And you must cut this flesh from off his breast;
 The law allows it, and the court awards it.

Shy. Most learned judge! A sentence! come, prepare.

Por. Tarry a little—there is something else—
 This bond doth give thee here no jot of blood;
 The words expressly are, a pound of flesh.
 Take then thy bond; take thou thy pound of flesh;
 But, in the cutting it, if thou dost shed
 One drop of Christian blood, thy lands and goods
 Are, by the laws of Venice, confiscate
 Unto the state of Venice.

Gratiano. O upright judge!—Mark, Jew!—O learned judge!

Shy. Is that the law?

Por. Thyself shall see the act:
 For, as thou urgest justice, be assured
 Thou shalt have justice, more than thou desirest.

Gra. O learned judge!—Mark, Jew!—a learned judge!

Shy. I take this offer, then; pay the bond thrice,
 And let the Christian go.

Bas. Here is the money.

Por. Soft;
 The Jew shall have all justice—soft!—no haste—
 He shall have nothing but the penalty.

Gra. O Jew! an upright judge! a learned judge!

Por. Therefore prepare thee to cut off the flesh.
 Shed thou no blood; nor cut thou less, nor more,
 But a just pound of flesh. If thou takest more,
 Or less than just a pound—be it but so much
 As makes it light or heavy in the substance',
 Or the division of the twentieth part
 Of one poor scruple'—nay, if the scale do turn
 But in the estimation of a hair'—
 Thou diest', and all thy goods are confiscate.
Gra. A second Daniel—a Daniel, Jew!
 Now, infidel, I have thee on the hip.

Por. Why doth the Jew pause? take thy forfeiture.

Shy. Give me my principal, and let me go.

Bas. I have it ready for thee; here it is.

Por. He hath refused it in the open court;
He shall have merely justice, and his bond.

Gra. A Daniel, still say I! a second Daniel!

I thank thee, Jew, for teaching me that word.

Shy. Shall I not have barely my principal?

Por. Thou shalt have nothing but the forfeiture,
To be so taken at thy peril, Jew.

Shy. Why, then the devil give him good of it!

I'll stay no longer question.

Por. Tarry, Jew;

The law hath yet another hold on you.

It is enacted in the laws of Venice,

If it be proved against an alien,

That, by direct or indirect attempts,

He seek the life of any citizen,

The party, 'gainst the which he doth contrive,

Shall seize one half his goods; the other half

Comes to the privy coffer of the state;

And the offender's life lies in the mercy

Of the duke only, 'gainst all other voice.

In which predicament, I say, thou standest;

For it appears, by manifest proceeding,

That indirectly, and directly too,

Thou hast contrived against the very life

Of the defendant; and thou hast incurred

The danger formerly by me rehearsed.

Down, therefore, and beg mercy of the duke.

Gra. Beg, that thou may'st have leave to hang thyself;

And yet, thy wealth being forfeit to the state,

Thou hast not left the value of a cord;

Therefore thou must be hanged at the state's charge.

Duke. That thou shalt see the difference of our spirit,

I pardon thee thy life before thou ask it.

For half thy wealth, it is Antonio's;

The other half comes to the general state.

LES. IV.—THE CHARACTER OF PORTIA, AS DISPLAYED IN THE TRIAL SCENE.

1. ALL the finest points of Portia's character are brought to bear in the trial scene which we have just read. There she shines forth all her divine self. Her intellectual powers, her high honorable principles, her best feelings as a woman, are all displayed. She maintains at first a calm self-command, as one sure of carrying her point in the end; yet the painful, heart-thrilling uncertainty in which she keeps the whole court,

until suspense verges upon agony, is not for effect merely ; it is necessary and inevitable.

2. She has two objects in view : to deliver her husband's friend, and to maintain her husband's honor by the discharge of his just debt, though paid out of her own wealth ten times over. She must be understood, from the beginning to the end, as examining with intense anxiety the effect of her words on the mind and countenance of the Jew ; as watching for that relenting spirit which she hopes to awaken either by reason or persuasion.

3. She begins by an appeal to his mercy, in that matchless piece of eloquence which, with an irresistible and solemn pathos, falls upon the heart like "gentle dew from heaven:" but in vain ; for that blessed dew drops not more fruitless and unfelt on the parched sand of the desert than do these heavenly words upon the ear of Shylock. She next attacks his avarice :

"Shylock, there's *thrice* thy money offered thee!"

Then she appeals, in the same breath, both to his avarice and his pity :

"Be *mer'ciful* !
Take *thrice*' thy money. Bid me *tear*' the bond."

4. All that she says afterward—her strong expressions, which are calculated to strike a shuddering horror through the nerves—the reflections she interposes—her delays and circumlocution, to give time for any latent feeling of commiseration to display itself—all, all are premeditated, and tend in the same manner to the object she has in view. Thus :

"You must prepare your bosom for his knife.
Therefore lay bare your bosom !"

These two speeches, though apparently addressed to Antonio, are spoken *at* Shylock, and are evidently intended to penetrate *his* bosom. In the same spirit she asks for the balance to weigh the pound of flesh, and entreats of Shylock to have a surgeon ready :

"Have by some surgeon', Shylock', on your charge,
To stop his wounds, lest he do bleed' to death !
Shylock. Is it so nominated in the bond' ?
Portia. It is not so expressed—but what of that' ?
'Twere good you do so much, for *charity*'."

5. So unwilling is her sanguine and generous spirit to resign all hope, or to believe that humanity is absolutely extinct in the bosom of the Jew, that she calls on Antonio, as a last resource, to speak for himself. His gentle, yet manly resignation—the deep pathos of his farewell, and the affectionate allusion to herself in his last address to Bassanio—

"Commend me to your honorable wife!
Say how I loved' you, speak me fair in death," etc.—

are well calculated to swell that emotion which, through the whole scene, must have been laboring suppressed within her heart.

6. At length the crisis arrives, for patience and womanhood can endure no longer; and when Shylock, carrying his savage bent "to the last hour of act," springs on his victim—"A sentence! come, prepare!" then the smothered scorn, indignation, and disgust burst forth with an impetuosity which interfere with the judicial solemnity she had at first affected, particularly in the speech,

"Therefore prepare thee to cut off the flesh.
Shed thou no blood; nor cut thou less, nor more,
But just a pound of flesh: if thou tak'st more,
Or less, than a just pound—be it but so much
As makes it light or heavy in the substance',
Or the division of the twentieth part
Of one poor scruple'; nay, if the scale do turn
But in the estimation of a hair',
Thou diest', and all thy goods are confiscate."

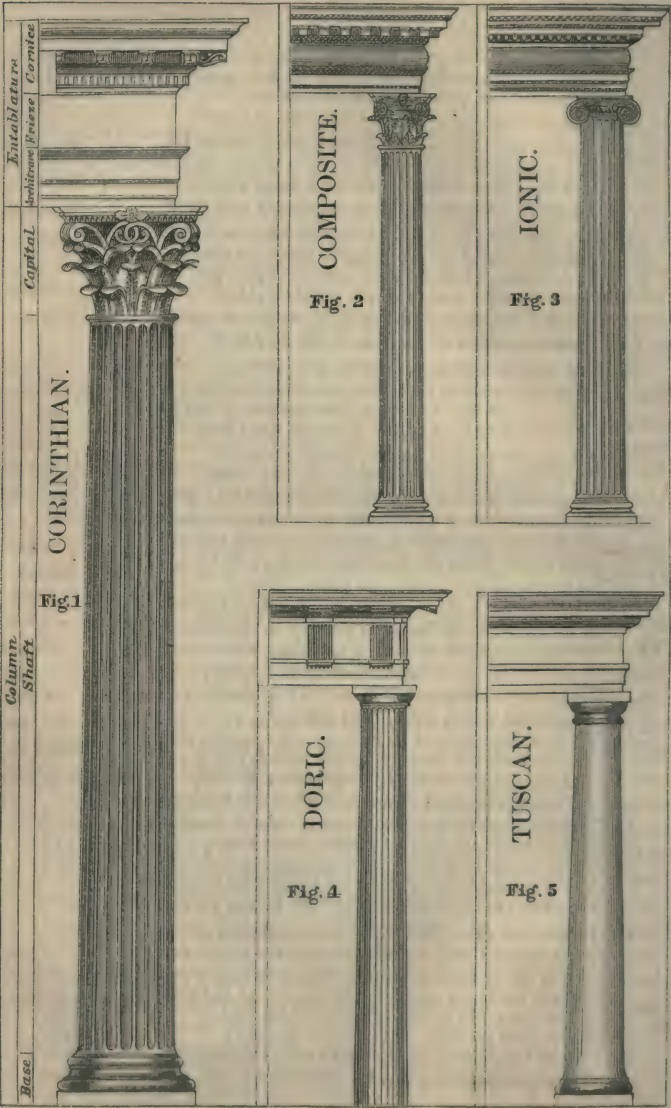
But she afterward recovers her propriety, and triumphs with a cooler scorn and a more self-possessed exultation.

7. It is clear that, to feel the full force and dramatic beauty of this marvelous scene, we must go along with Portia as well as with Shylock; we must understand her concealed purpose, keep in mind her noble motives, and pursue in our fancy the under-current of feeling working in her mind throughout. The terror and the power of Shylock's character—his deadly and inexorable malice—would be too oppressive, the pain and pity too intolerable, and the horror of the possible issue too overwhelming, but for the intellectual relief afforded by this double source of interest and contemplation.—MRS. JAMESON.

LESSON V.—THE PHILOSOPHER'S SCALES.

1. A MONK, when his rites sacerdotal were o'er,
In the depth of his cell with his stone-covered floor,
Resigning to thought his chimerical brain,
Once formed the contrivance we now shall explain;
But whether by magic's or alchemy's powers
We know not; indeed, 'tis no business of ours.
2. Perhaps it was only by patience and care,
At last, that he brought his invention to bear:
In youth 'twas projected, but years stole away,
And ere 'twas complete he was wrinkled and gray;
But success is secure unless energy fails;
And, at length, he produced THE PHILOSOPHER'S SCALES.

3. "What were they'?" you ask ; you shall presently see :
These scales were not made to weigh sugar and tea ;
Oh no ; for such properties wondrous had they,
That *qualities, feelings, and thoughts* they could weigh ;
Together with articles small or immense,
From mountains or planets to atoms of sense.
4. Naught was there so bulky but there it would lay,
And naught so ethereal but there it would stay,
And naught so reluctant but in it must go—
All which some examples more clearly will show.
5. The first thing he weighed was the head of Voltaire,
Which retained all the wit that had ever been there ;
As a weight, he threw in a torn scrap of a leaf,
Containing the prayer of the penitent thief ;
When the skull rose aloft with so sudden a spell,
That it bounced like a ball on the roof of the cell.
6. One time he put in Alexander the Great,
With the garment that Dorcas had made, for a weight,
And, though clad in armor from sandals to crown,
The hero rose up, and the garment went down.
7. A long row of alms-houses, amply endowed
By a well-esteemed Pharisee, busy and proud,
Next loaded one scale ; while the other was pressed
By those mites the poor widow dropped into the chest ;
Up flew the endowment, not weighing an ounce,
And down, down the farthing-worth came with a bounce.
8. By further experiments (no matter how),
He found that ten chariots weighed less than one plow ;
A sword with gilt trapping rose up in the scale,
Though balanced by only a tenpenny nail ;
A shield and a helmet, a buckler and spear,
Weighed less than a widow's uncrystallized tear.
9. A lord and a lady went up at full sail,
When a bee chanced to light on the opposite scale ;
Ten doctors, ten lawyers, two courtiers, one earl,
Ten counselors' wigs, full of powder and curl,
All heaped in one balance and swinging from thence,
Weighed less than a few grains of candor and sense ;
A first water diamond, with brilliants begirt,
Than one good potato just washed from the dirt ;
Yet not mountains of silver and gold could suffice
One pearl to outweigh—'twas THE PEARL OF GREAT PRICE.
10. Last of all, the whole world was bowled in at the grate,
With the soul of a beggar to serve for a weight,
When the former sprang up with so strong a rebuff,
That it made a vast rent and escaped at the roof !
When balanced in air, it ascended on high,
And sailed up aloft, a balloon in the sky ;
While the scale with the soul in 't so mightily fell,
That it jerked the philosopher out of his cell.—JANE TAYLOR.



PART VI.

CIVIL ARCHITECTURE.

LESSON I.—GRECIAN AND ROMAN ARCHITECTURE.

1. ARCHITECTURE is the art of contriving and constructing buildings; and, when the term is used without a qualifying adjective, the designing and building of civil and religious edifices, such as palaces, mansions, theatres, churches, courts, bridges, etc., is intended; and it is called civil, to distinguish it from naval and military architecture.

2. The architecture of the Greeks, and of their successors the Romans, is generally divided into certain *orders*, whose names characterize the several modes in which these people constructed the façades,¹ or fronts of their temples. Thus the Greeks had three prominent orders or styles of architecture, the Doric, the Ionic, and the Corinthian; each of which, as may be seen on the opposite page, may be represented by a single column, together with the base or platform on which it rests, and the roof-like covering which it aids in supporting.

3. Certain definite proportions, supposed to combine the highest degree of grace and beauty, were assigned to each. The crowning superstructure of an order is called the entablature,² and is divided into architrave,³ frieze,⁴ and cornice (see opposite page). The *Doric* order, as used by the Greeks, and as seen in its best specimen, the famous Parthenon, or Temple of Minerva, at Athens, was without a base; yet the Romans not only gave it a base, but, changing some of its features, they constructed from it another order, called the *Tuscan*.

4. The *Ionic*, the second of the Grecian orders, not only has a base, and a capital and entablature differing from the Doric, but the shaft of its column is lighter and more graceful in its proportions. The volutes, or curves of its capital, introduce a new element of beauty. Their design is said by some to have been suggested by the curls of hair on each side of the human face, and by others to have been taken from the curling of the bark of a rude upright post, caused by a crushing weight laid upon it.

5. The third Grecian order is the ornate *Corinthian*, which is conspicuous for the beauty of its capital, and the exceeding grace and symmetry of all its parts. The invention of this

order is attributable to Callimachus,⁵ an Athenian sculptor of the age of Pericles, who is said to have had the idea of its capital suggested to him by observing acanthus leaves growing around a basket which had been placed, with some favorite trinkets, upon the grave of a young Corinthian lady—the tops of the leaves, and the stalks which arose among them, having been turned down and formed into slender volutes by a square tile which covered the basket.

6. The Corinthian order was the one most extensively employed by the Romans in their public buildings; but they loaded every member with ornaments unknown to the inventors. They also combined the Ionic and the Corinthian, and formed a fifth order, which they ornamented to profusion, and named the *Composite*. Its chief distinguishing feature is the capital, which has four volutes, presenting the same face in four directions. (See p. 282.)

7. But to one important feature in architecture the Romans appear to have indubitable claim, and that is the *arch*. It is generally believed that the ancient Egyptians, Persians, and Hindoos were entirely ignorant of its construction; and it seems probable that the Greeks knew nothing of it previous to the Roman conquest—certain it is they knew not its advantages in architecture. The Romans made great use of it in their temples, in their famous aqueducts, and their triumphal arches; and when we now characterize any architecture as decidedly *Roman*, reference is had to that feature which is denoted by the perfected arch, or *dome*.

8. What is known as *Gothic* architecture sprung up in the Gothic nations of Europe when Christianity was introduced among them, and was generally used in church edifices during the Middle Ages. Based upon the Roman style, it adopted the rounded or semicircular *arch* as its distinguishing feature, and was at first exceedingly clumsy in form; but as a taste for the fine arts began to show itself, architecture assumed a different and novel aspect; the plain rounded arch gave place to a more pointed form and quaint mouldings; tall spires crowned the structure; windows of stained glass shed gorgeous lights over the profuse decorations of the interior; and the Gothic or *Christian* style was at length perfected, as scientific in its principles as it was grand and imposing in appearance. (See p. 289.)

¹ FA-CĀDE' (fa-sāde').

² EN-TĀH'-LA-TŪRE.

³ ĀRECH'-Ī-TRĀVE.

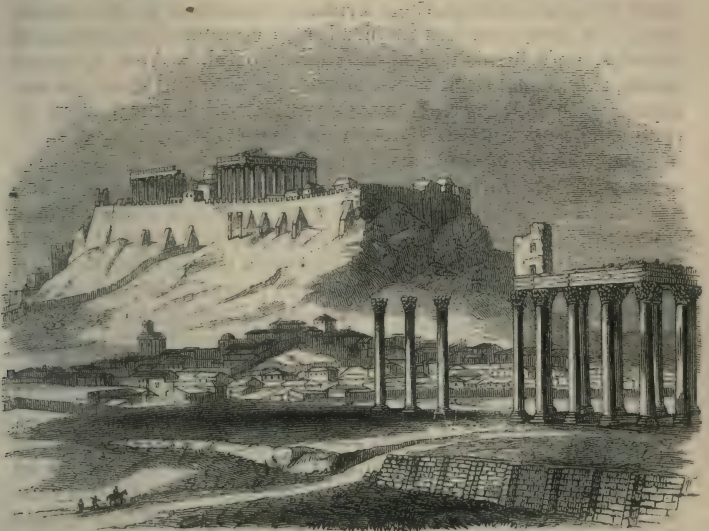
⁴ FRIEZE (freez).

⁵ CAL-LĪM'-A-CHUS.

LESSON II.—ATHENIAN ARCHITECTURE DURING THE AGE OF PERICLES.

BULWER.

[The "Age of Pericles" embraced the latter half of the fifth century before Christ, when Pericles, at the head of Athenian affairs, raised Athens to the summit of her renown. It was during this period that most of those famous structures which crowned the Athenian Acropolis, or surrounded its base, were either built or adorned by the direction of Pericles, under the superintendence of the sculptor Phidias. The most famous of all these was the *Parthenon*, which crowned the summit of the Acropolis, and whose ruins are seen in the annexed engraving. The following extract from Bulwer's *Athens* will convey to the reader a vivid idea of the unrivalled grace and elegance of the Athenian edifices of the time of Pericles. See *Historical Part*, p. 507.]



MODERN ATHENS.—The above is a south view of Athens in its present state, from the left bank of the Ilissus, showing the Athenian Acropolis in the distance, surmounted by the ruins of the Parthenon in the centre. See also p. 308.

1. THEN rapidly progressed those glorious fabrics which seemed, as Plutarch gracefully expresses it, endowed with the bloom of a perennial youth. Still the houses of private citizens remained simple and unadorned, still the streets were narrow and irregular; and even centuries after, a stranger entering Athens would not at first have recognized the claims of the mistress of Grecian art. But to the homeliness of her common thoroughfares and private mansions, the magnificence of her public edifices now made a dazzling contrast. The Acropolis, that towered above the homes and thorough-

fares of men—a spot too sacred for human habitation—became, to use a proverbial phrase, “a city of the gods.” The citizen was every where to be reminded of the majesty of the STATE—his patriotism was to be increased by the pride in her beauty—his taste to be elevated by the spectacle of her splendor.

2. Thus flocked to Athens all who, throughout Greece, were eminent in art. Sculptors and architects vied with each other in adorning the young empress of the seas; then rose the master-pieces of Phidias,¹ of Callicrates,² of Mnesicles,³ which, either in their broken remains or in the feeble copies of imitators less inspired, still command so intense a wonder, and furnish models so immortal. And if, so to speak, their bones and relics excite our awe and envy, as testifying of a lovelier and grander race, which the deluge of time has swept away, what, in that day, must have been their brilliant effect—unmutilated in their fair proportions—fresh in all their lineaments and hues? For their beauty was not limited to the symmetry of arch and column, nor their materials confined to the marbles of Pentelicus⁴ and Paros.⁵ Even the exterior of the temples glowed with the richest harmony of colors, and was decorated with the purest gold; an atmosphere peculiarly favorable both to the display and the preservation of art, permitted to external pediments⁶ and friezes⁷ all the minuteness of ornament, all the brilliancy of colors, such as in the interior of Italian churches may yet be seen; vitiated, in the last, by a gaudy and barbarous taste.

3. Nor did the Athenians spare any cost upon the works that were, like the tombs and tripods of their heroes, to be the monuments of a nation to distant ages, and to transmit the most irrefragable⁸ proof “that the power of ancient Greece was not an idle legend.” The whole democracy were animated with the passion of Pericles; and when Phidias recommended marble as a cheaper material than ivory for the great statue of Minerva, it was for that reason that ivory was preferred by the unanimous voice of the assembly. Thus, whether it were extravagance or magnificence, the blame in one case, the admiration in another, rests not more with the minister than the populace. It was, indeed, the great characteristic of those works that they were entirely the creation of the people: without the people Pericles could not have built a temple or engaged a sculptor. The miracles of that day resulted from the enthusiasm of a population yet young—full of the first ardor for the beautiful—dedicating to the state, as

to a mistress, the trophies honorably won or the treasures injuriously extorted—and uniting the resources of a nation with the energy of an individual, because the toil, the cost, were borne by those who succeeded to the enjoyment and arrogated the glory.

¹ PHID'-I-AS was a celebrated sculptor of Athens, whom Pericles appointed superintendent of all the public works, both of architecture and statuary.

² CAL-Lĭe'-RA-TĒS, in conjunction with Ictinus, built the Parthenon at Athens.

³ MNĒS'-I-CLĒS, a celebrated architect, born a slave in the house of Pericles.

⁴ PEN-TEL'-I-CUS, a mountain of Attica, containing quarries of beautiful marble.

⁵ PĀ'-ROS, an island in the Grecian Archi-

pelāgo, famous for the "Parian marble" which the Greeks used for statuary.

⁶ PĒD'-I-MENT, an ornament that crowns the front of buildings, and serves as a decoration over gates, windows, etc.

⁷ FRIĒZE (*frieze*), that part of the EN-TĀB'-LA-TŪRE between the ĀRCH'-Ī-TRĀVE and CŌB'-NICE (*cornice*). See p. 282.

⁸ IR-RĒF'-RA-GA-BLE, that can not be refuted; indisputable.

LESSON III.—RUINS OF THE COLISĒ'UM AT ROME.



1.

ARCHES on arches! as it were that Rome,
Collecting the chief trophies of her line,
Would build up all her triumphs in one dome,
Her Coliseum stands; the moonbeams shine
As 'twere its natural torches, for divine
Should be the light which streams here, to illum
This long explored but still exhaustless mine
Of contemplation: and the azure gloom
Of an Italian night, where the deep skies assume
Hues which have words, and speak to ye of heaven,
Floats o'er this vast and wondrous monument,

And shadows forth its glory. There is given
 Unto the things of earth, which Time hath bent,
 A spirit's feeling; and where he hath leant
 His hand, but broke his scythe, there is a power
 And magic in the ruin'd battlement,
 For which the palace of the present hour
 Must yield its pomp, and wait till ages are its dower.—BYRON.

2. In the open space between the Esquiline and Palatine Hills are to be seen the ruins of the Colisē'um, or Flavian Amphitheatre, as they are represented in the engraving at the head of this lesson. This gigantic edifice, the boast of Rome and of the world, which was begun by Vespasian and completed by Titus, is in form an ellipse, and covers an area of about five and a half acres. The external elevation consisted of four stories—each of the three lower stories having eighty arches supported by half columns, Doric in the first range, Ionic in the second, and Corinthian in the third. The wall of the fourth story was faced with Corinthian pilasters,¹ and lighted by forty rectangular windows. The space surrounding the central arena within the walls was occupied with sloping galleries, rising one above another, resting on a huge mass of arches, and ascending toward the summit of the external wall. One hundred and sixty staircases led to the galleries, and an immense movable awning covered the whole.

3. Within the area of the Coliseum gladiators, martyrs, slaves, and wild beasts combated during the Roman festivals; and here the blood of both men and animals flowed in torrents to furnish amusement to the degenerate Romans. This famous structure is now partially in ruins: scarcely a half presents its original height; the uppermost gallery has disappeared; the second range is much broken; but the lowest is nearly perfect. From its enormous mass "walls, palaces, half cities have been reared;" but Benedict XIV. put a stop to its destruction by consecrating the whole to the martyrs whose blood had been spilled there. In the middle of the once bloody arena stands a crucifix, and around this, at equal distances, fourteen altars, consecrated to different saints, are erected on the dens once occupied by wild beasts.

4. Byron has described, in appropriate lines, "the Coliseum at midnight;" and an American writer has given a much-admired sketch of the same "by moonlight." The latter says, "It is the monarch, the majesty of all ruins; there is nothing like it. Though a mournful and desolate spectacle as seen from within—without, and especially on the side which is in best preservation, it is glorious."

¹ PŪ-LĀS'-TERS are square columns, usually set within walls, and projecting only one quarter of their diameter.

GOTHIC ARCHITECTURE.

LES. IV.—CASTLES AND ABBEYS OF FEUDAL TIMES.



1. Double semicircular Saxon-Norman arch, from window of St. Alban's Abbey, A.D. 1100. 2. Double lancet-pointed arch, from window of Salisbury Cathedral, A.D. 1260. 3. Window of Exeter Cathedral, compound ogee arch, with compound-curve tracery, A.D. 1400. The figures 4, 5, 6, 7, 8, 9, show the gradual advance from the simple to the more elaborate forms exhibited in the spires of Gothic edifices.

1. ENRAPTURED have I loved to roam,
 A lingering votary, 'neath vaulted dome,
 Where the tall shafts, that mount in massy pride,
 Their mingling branches shoot from side to side;
 Where elfin¹ sculptors, with fantastic clew,²
 O'er the long roof their wild embroidery drew;
 Where superstition, with capricious hand,
 In many a maze the wreathed window plann'd,
 With hues romantic tinged the gorgeous pane,
 To fill with holy light the wondrous fane.³

2. Long have I loved to catch the simple chime
 Of minstrel harps, and spell the fabling rhyme;
 To view the festive rites, the knightly play,
 That deck'd heroic Albion's⁴ elder day;
 To mark the mouldering halls of barons bold,
 And the rough castles, cast in giant mould;
 With Gothic manners Gothic arts explore,
 And muse on the magnificence of yore.—WATSON.

3. The castles and abbeys of feudal times, which were chiefly of Gothic architecture, with either rounded or pointed arches, pointed spires, and massive walls, enter so much into the

modern history and literature of Europe, that every student must have connected with them, through his varied reading, associations of lively interest. It is true that their graver history—in the times “when might made right”—when turbulence and faction were in the ascendant—presents frequent scenes of tyranny and injustice; but with these, as a glad relief, are associated a thousand pleasing and faithful pictures of social life.

4. It was in the Gothic palaces, castles, abbeys, halls, and manor-houses of England especially, our mother country, that both religious festivals and feats of chivalry were celebrated in all their splendor. It was there that the noble host collected around him his friends and retainers; that the walls were hung with banners; that steel-clad warders paced the battlements; that the sound of the horn summoned the guests from the “joust”⁵ or the chase; and that the “wandering harper” sang those romantic and heroic ballads at which the young caught fire, and the old threw aside the weight of years. An English writer, who has prepared a richly-illustrated work on “The Castles and Abbeys of England,” thus speaks of these “fixed landmarks in England’s history:”

5. “We linger in the feudal court, and muse in the deserted sanctuary, with emotions which we can hardly define: in the one our patriotism gathers strength and decision; in the other, that piety, of which it is the outward evidence, sheds a warmer influence on the heart. We traverse the apartments that once contained the noble founders of our national freedom, the venerable and intrepid champions of our faith, the revered fathers of our literature, with a feeling which amounts to almost devotion. We turn aside to the mouldering gates of our ancestors as a pilgrim turns to some favorite shrine; to those ruins which were the cradles of liberty, the residence of men illustrious for their deeds, the strong-hold and sanctuary of their domestic virtues and affections.

6. “The mutilated altars of our religion, the crumbling sepulchres of our forefathers, are pregnant with an interest which no other source can afford. In these venerable remains, the visible stamp of sanctity still clings to the threshold; we tread the ground with a soft, silent step, overawed by the solemnity of the scene; we feel that—although the sacred fire is extinguished on the altar, the hallelujahs hushed in the choir, the priest and penitent gone forever—we feel that the presence of a divinity still hallows the spot; that the wings of the presiding cherubim are still extended over the altar.

7. “But, turning from the cloistered abbey to the castellated fortress of antiquity, a new train of associations springs up. The vaulted gateway, the rudely sculptured shield, the heavy portcullis,⁶ and massive towers, all contrast forcibly with the scenes we have just left, but present to the mind’s eye a no less faithful picture of feudal times. It was from these towers that the flower of English chivalry went forth under the banner of the Cross—carried the terror of their arms to the gates of Jerusalem, and earned those

glorious 'badges' which are now the proud distinction of their respective houses.

8. "In a survey of these primitive strong-holds, these rude citadels of our national faith and honor, every feature is invested with traditionary interest. They are intimately associated with our native literature, civil and sacred; with history, poetry, painting, and the drama; with local tradition, and legendary and antiquarian lore."—WILLIAM BEATTIE, M.D.

9. Gothic architecture in England has passed through several gradations or stages, which very truly mark the successive historical eras. Thus, in the Abbey of St. Alban's may still be seen remains of the ancient Saxon, with its ponderous columns and broad semicircular arches.

In Saxon strength that abbey frown'd,
With massive arches, broad and round,
That rose alternate, row on row,
On ponderous columns short and low.—SCOTT.

10. Yet in this very same structure the Norman style—which gives to the arch its first slight tendency toward a pointed appearance, introducing a rudely foliated⁷ capital and a moulded base, and clustered and lighter columns, but still rejecting the pointed spires of the later Gothic—is introduced upon a Saxon basis, new and lighter arches having been thrown in, and the massive clustered pillars having been evidently chiseled, at vast labor and expense, out of the original Saxon, thus ingrafting the new style upon the primitive stock. Thus the old Saxon abbey becomes a fine specimen of the more modern Norman-Gothic.

11. "Bold is the abbey's front, and plain;
The walls no shrined saint sustain,
Nor tower nor airy pinnet⁸ crown;
But broadly sweeps the Norman arch
Where once in brighten'd shadow shone
King Offa⁹ on his pilgrim-march,
And proudly points the moulder'd stone
Of the high vaulted porch beneath,
Where Norman beauty hangs a wreath
Of simple elegance and grace:
Where slender columns guard the space
On every side, in cluster'd row,
The triple arch through arch disclose,
And lightly o'er the vaulting throw
The thwart-rib and the fretted rose."

12. The great western entrance of this celebrated abbey, which consists of a projecting porch elaborately ornamented, niched, and pillared, and subdivided into numerous compartments, shows a varied mingling of the styles of different ages.

"Beside this porch, on either hand,
Giant buttresses darkly stand,
And still their silent vanguard hold
For bleeding knights laid here of old;
And Mercian Offa and his queen
The portals guard and grace are seen.
This western front shows various style,
Less ancient than the central pile.

It seems some shade of parted years
 Left watching o'er the mouldering dead,
 Who here for pious Henry bled,
 And here, beneath the wide-stretch'd ground
 Of nave,¹⁰ of choir,¹¹ of chapels round,
 Forever—ever rest the head."¹²

13. In the engraving at the head of this lesson are represented the different eras of Gothic architecture in England, by references to the windows of Gothic edifices of different periods—exhibiting a gradual progress from the broad and plain semicircular Saxon-Norman style to the pointed and oggee¹³ arches, compound curves, and beautiful flowing tracery of later times. It is to this latter style of tracery that Scott so beautifully refers, in his description of Melrose Abbey:

14. "The moon on the east oriel¹⁴ shone
 Through slender shafts of shapely stone
 By foliated tracery combined;
 Thou wouldst have thought some fairy's hand
 'Twixt poplars straight the osier wand
 In many a freakish knot had twined;
 Then framed a spell when the work was done,
 And turn'd the willow wreaths to stone."

15. It is pleasant to linger over these monumental relics, with which is associated so much of the history, literature, and religion of modern times. But, while they speak of the past, they also convey, in their broken arches and mouldering columns, the same lesson that is taught by older ruins of a pagan age—that this is a "fleeting world," and that the proudest monuments which man can raise are doomed to crumble beneath the touch of time.

16. When yonder broken arch was whole,
 'Twas there was dealt the weekly dole;¹⁵
 And where yon mouldering columns nod,
 The abbey sent the hymn to God.
 So fleets the world's uncertain span;
 Nor zeal for God, nor love to man,
 Gives mortal monuments a date
 Beyond the power of time and fate.
 The towers must share the builder's doom;
 Ruin is theirs, and his a tomb:
 But better boon benignant heaven
 To faith and charity has given,
 And bids the Christian hope sublime
 Transcend the bounds of fate and time.—SCOTT.

¹ ELF'-IN, pertaining to elves or fairies.

² C'LEW, thread used in the embroidery.

³ FANE, a temple; a church.

⁴ AL'-BI-ON, here used for England.

⁵ JOUST (*jüst*), a tilt; a tournament.

⁶ PORT-CUL'-LIS, a frame armed with iron over a gateway, to be let down for defense.

⁷ FÖ'-LI-Ä-TED, in the form of leaves.

⁸ PIN-NET, for pinnacle.

⁹ The Saxon Offa, king of the Mercians, the supposed founder of the Abbey of St. Alban's, lived near the close of the eighth century.

¹⁰ NAVE, the middle of a church.

¹¹ CHOIR (*kwire*), the part of a church appropriated to the singers. In most modern churches the singers are placed in certain seats in the galleries.

¹² The bones of the British martyr, St. Albanus, are said to have been deposited in a gorgeous shrine within the walls of the abbey.

¹³ O-GE'E', a moulding somewhat like the letter S.

¹⁴ O'-RI-EL, a bay-window, or curved window projecting outward.

¹⁵ DOLE, a gift; a pittance.

LESSON V.—OF THE USEFUL IN ARCHITECTURE.

A. J. DOWNING.



1. THE senses make the first demand in almost every path in human life. The necessity of shelter from the cold and heat, from sun and shower, leads man at first to *build a habitation*.

2. What this habitation shall be depends partly on the habits of the man, partly on the climate in which he lives. If he is a shepherd, and leads a wandering life, he pitches a tent. If he is a hunter, he builds a rude hut of logs or skins. If he is a tiller of the soil, he constructs a dwelling of timber or stones, or lodges in the caverns of the rocky hill sides.

3. As a mere animal, man's first necessity is to provide a shelter; and, as he is not governed by the constructive instinct of other animals, the clumsiest form which secures him against the inclemency of the seasons often appears sufficient; there is scarcely any design apparent in its arrangement, and the smallest amount of convenience is found in its interior. This is the first primitive or savage idea of building.

4. Let us look a step higher in the scale of improvement. On the eastern borders of Europe is a tribe or nation called the Croats, who may be said to be only upon the verge of civilization. They lead a rude forest and agricultural life.

They know nothing of the refinements of the rest of Europe. They live in coarse, yet strong and warm houses. But their apartments are as rude as their manners, and their cattle frequently share the same rooms with themselves.

5. Our third example may be found in many portions of the United States, and especially on our Western frontiers. It is nothing less common than a plain rectangular house, built of logs, or of timber from the forest saw-mill, with a roof to cover it, windows to light it, and doors to enter it. The heat is perhaps kept out by shutters, and the cold by fires burnt in chimneys. It is well and strongly built; it affords perfect protection to the physical nature of man; and it serves, so far as a house can serve, all the most imperative wants of the body. It is a warm, comfortable, convenient dwelling.

6. It is easy to see that in all these grades of man's life, and the dwellings which typify them, only one idea has as yet manifested itself in his architecture—that of utility. In the savage, the half civilized, and the civilized states, the idea of the useful and the convenient differ, but only in degree. It is still what will best serve the body—what will best shelter, lodge, feed, and warm us—which demands the whole attention of the mere builder of houses.

7. It would be as false to call only this architecture as to call the gamut music, or to consider rhymes poetry; and yet it is the frame-work or skeleton on which architecture grows and wakens into life; without which, indeed, it can no more rise to the dignity of a fine art than perfect language can exist without sounds.

LESSON VI.—OF EXPRESSION IN CIVIL OR PUBLIC ARCHITECTURE.

1. PASSING beyond the merely *useful* in building, which is limited by man's necessities, the chief *beauty* of architecture, considered as one of the fine arts, is to be found in the expression of elevated and refined ideas of man's life. The first and most powerful expressions of this art are those of man's public life or of his religious and intellectual nature, as seen in the temple, the church, the capitol, or the gallery of art. Its secondary expression is confined to the manifestation of his social and moral feelings, as shown in the dwellings which he inhabits.

2. In the forms of the Gothic cathedral are embodied the worshiping principle in man—the loving reverence for that which is highest and holiest, and the sentiment of Christian brotherhood. These harmonies are expressed in the principal lines, which are all vertical—that is, aspiring—tending upward; in the circumstance that the whole mass falls under or within the *pyramidal* form, which is that of flame or fire, symbolical of love; in the pointed character of all the openings, which, as expressive of firmness of base, denotes embracingness of tendency and upward ascension as its ultimate aim, and in the clustering and grouping of its multiple parts. Gothic architecture being thus representative rather of the unity of love than of the diversities of faith, it seems proper that it should be the style for all ecclesiastical and other purposes having reference to religious life.

3. But other forms of architecture are equally expressive. In Roman art we see the ideal of the *State* as fully manifested as is, in Gothic, the ideal of the Church. Its type-form, based on the simple *arch*, is the *dome*—the encircling, overspreading dome, whose centre is within itself, and which is the binding together of all for the perfection and protection of the whole. Hence the propriety of using this style in state-houses, capitol, Parliament-houses, town-halls, where this idea is to be expressed.

4. Again: we have, in the Greek temple, as it is found in the several Grecian orders, still another architectural type. As these orders have their individual expressions, as shown in the simple and manly Doric, the chaste Ionic, and the ornate Corinthian, they furnish the most suitable varieties of a harmoniously elegant style that can be conceived for simple halls, for courts of justice, for schools, and for public, oratorical, lecture, and philosophical rooms. Hence buildings which have but one object, and which require one expression of that object, can not be built in a style better adapted to convey the single idea of their use than in the Grecian temple form. Here every thing falls under the *horizontal* line—the level line of rationality; it is all logical, orderly, syllogistically perfect, as the wisdom of the schools.—*Literary World*.

LESSON VII.—OF EXPRESSION IN DOMESTIC ARCHITECTURE.

A. J. DOWNING.



A suburban villa residence.

1. IN domestic architecture, though the range of expression may at first seem limited, it is not so in fact; for, when complete, it ought to be significant of the whole private life of man—his intelligence, his feelings, and his enjoyments.

2. If we pass an ill-proportioned dwelling, in which the walls and roof are built only to defend the inmates against cold and heat, the windows intended for nothing but to admit the light and exclude the air, the chimneys constructed only to carry off the smoke, the impression which that house makes upon us at a glance is that of mere utility.

3. If, on the other hand, the building is well proportioned; if there is a pleasing symmetry in its outward form; and, should it be large, if it display variety, harmony, and unity, we feel that it possesses much absolute beauty—the beauty of a fine form.

4. If, in addition to this, we observe that it has various marked features, indicating intelligent and cultivated life in its inhabitants; if it plainly shows, by its various apartments, that it is intended not only for the physical wants of man, but for his moral, social, and intellectual existence; if hospitality

smiles in ample parlors; if home virtues dwell in cozy fireside family rooms; if the love of the beautiful is seen in picture or statue galleries, intellectuality in well-stocked libraries, and even a dignified love of leisure and repose in cool and spacious verandas¹, we feel, at a glance, that here we have reached the highest beauty of which domestic architecture is capable—that of individual expression.

5. Hence every thing in architecture that can suggest or be made a symbol of social or domestic virtues, adds to its beauty and exalts its character. Every material object that becomes the type of the spiritual, moral, or intellectual nature of man, becomes at once beautiful, because it is suggestive of the beautiful in human nature.

6. We are bound to add here that, in all arts, other thoughts may be expressed besides those of beauty. Vices may be expressed in architecture as well as virtues; the worst part of our natures as well as the best. A house built only with a view to animal wants, eating and drinking, will express sensuality instead of hospitality. A residence marked by gaudy and garish apartments, intended only to dazzle and impress others with the wealth or importance of the proprietor, will express pride and vanity instead of a real love of what is beautiful for its own sake; and a dwelling in which a large and conspicuous part is kept for show, to delude others into the belief of dignity or grace on our part, while our actual life is one in mean apartments, expresses any thing but honest sincerity of character.

7. The different *styles* of domestic architecture, as the Roman, the Italian, the Swiss, the Venetian, the rural Gothic, are nothing more than expressions of national character, which have, through long use, become permanent. Thus the gay and sunny temperament of the south of Europe is well expressed in the light balconies,² the grouped windows, the open arcades,³ and the statue and vase bordered terraces of the Venetian and Italian villas; the homely, yet strong and quaint character of the Swiss in their broad-roofed, half rude, and curiously constructed cottages; the domestic virtues, the love of home, rural beauty and seclusion, can not possibly be better expressed than in the English cottage, with its many upward-pointing gables,⁴ its intricate tracery, its spacious bay-windows, and its walls covered with vines and flowering shrubs.

8. So far as an admiration of foreign style in architecture arises from the mere love of novelty, it is poor and contemptible; so far as it arises from an admiration of truthful beauty

of form or expression, it is noble and praiseworthy. A villa in the style of a Persian palace, with its Oriental domes and minarets,⁵ equally unmeaning and unsuited to our life or climate, is an example of the former; as an English cottage, with its beautiful home expression, and its thorough comfort and utility, evinced in steep roofs to shed the snow, and varied form to accommodate modern habits, is of the latter.

9. Domestic architecture should be less severe—less rigidly scientific—than in public buildings; and it should exhibit more of the freedom and play of feeling of every-day life. A man may, in public halls, recite a poem in blank verse, or deliver a studied oration with the utmost propriety; but he would be justly the object of ridicule if at the fireside he talked about the weather, his family, or his friend in the same strain.

10. What familiar conversation, however tasteful and well-bred, is to public declamation, domestic is to civil or ecclesiastical architecture; and we have no more patience with those architects who give us copies of the Temple of Theseus, with its high, severe colonnades, for dwellings, than with a friend who should describe his wife and children to us in the lofty rhythm of Ossian. For this reason the Italian, Venetian, Swiss, rural Gothic, and our bracketed style, which are all modified and subdued forms of the Gothic and Greek styles, are the variations of those types most suitable for domestic architecture.

¹ VE-RĀN'-DA, an open portico.

² BĀL'-CO-NY, a gallery on the outside of a house.

³ ĀR-CĀDE', a continuous arch or series of arches.

⁴ GĀ'-BLE, the triangular or sloping end of a house, called the gable-end.

⁵ MĪN'-A-RET, a slender lofty turret on mosques, with a balcony from which the people are called to prayer.

LESSON VIII.—THE POETRY OF COTTAGE ARCHITECTURE.

Adapted from LOUDON'S *Magazine*.

1.

The cottage homes of England!
By thousands on her plains,
They are smiling o'er the silvery brooks,
And round the hamlet fanes.
Through glowing orchards forth they peep,
Each from its nook of leaves,
And fearless there the lowly sleep,
As the bird beneath their eaves.—HEMANS.

2. Of all embellishments by which the efforts of man can enhance the beauty of natural scenery, those are the most effective which can give animation to the scene, while the spirit which they bestow is in unison with its general character. It is generally desirable to indicate the presence of ani-



A neat cottage residence.

mated existence in a scene of natural beauty, but only of such existence as shall be imbued with the spirit, and partake of the essence of the beauty, which without it would be dead. If our object, therefore, is to embellish a scene, the character of which is peaceful and unpretending, we must not erect a building which shall be expressive of the abode of wealth or pride.

3. However beautiful or imposing in itself, such an object immediately indicates the presence of a kind of existence unsuited to the scenery which it inhabits, and of a mind which, when it sought retirement, was unacquainted with its own ruling feelings, and which consequently excites no sympathy in ours; but if we erect a dwelling which may appear adapted to the wants, and sufficient for the comfort of a gentle heart and lowly mind, we have attained our object; we have bestowed animation, and we have not disturbed repose.

4. It is for this reason that the cottage is one of the embellishments of natural scenery which deserves attentive consideration. It is beautiful always and every where; and whether looking out of the woody dingle with its eyelike window, and sending up the motion of azure smoke between the silver trunks of aged trees, or grouped among the bright corn-fields of the fruitful plain, or forming gray clusters along the slope of the mountain side, the cottage always gives the idea of a thing to be beloved—a quiet, life-giving voice, that is as peaceful as silence itself.

5. The principal thing worthy of observation in a finished cottage is its all-pervading neatness, and the expression of tranquil repose. The swallow or the martin is permitted to attach his humble domicile, in undisturbed security, to the eaves; but he may be considered as enhancing the effect of

the cottage by increasing its usefulness, and making it contribute to the comfort of more beings than one. The white-wash is stainless, and its rough surface catches a side light as brightly as a front one; the luxuriant rose is trained gracefully over the window; and the gleaming lattice, divided, not into heavy squares, but into small-pointed diamonds, is thrown half open, as is just discovered among the green leaves of the sweet brier, to admit the breeze, that, as it passes over the flowers, becomes full of their fragrance.

6. The bright wooden porch breaks the flat of the cottage face by its projection, and branches of the wandering honeysuckle spread over its low hatch. A few square feet of garden, and a latched wicket, inviting the weary and dusty pedestrian to lean upon it for an instant, and request a drink of water or milk, complete a picture which, if it be far enough from the city to be unspoiled by town sophistications, is a very perfect thing in its way. The ideas it awakens are agreeable, and the architecture is all that we want in such a situation. It is pretty and appropriate; and, if it boasted of any other perfection, it would be at the expense of its propriety.

LESSON IX.—THE SHEPHERD'S COTTAGE

1. WHERE woods of ash, and beech,
And partial cōpses fringe the green hill foot,
The upland shepherd rears his modest home;
There wanders by a little nameless stream
That from the hill wells forth, bright now and clear,
Or after rain with chalky mixture gray,
But still refreshing in its shallow course
The cottage garden—most for use designed,
Yet not of beauty destitute. The vine
Mantles the little casement; yet the brier
Drops fragrant dew among the July flowers;
And pansies ray'd, and freak'd¹ and mottled pinks,
Grow among balm, and rosemary, and rue;
There honeysuckles flaunt, and roses blow
Almost uncultured; some with dark green leaves
Contrast their flowers of pure unsullied white;
Others like velvet robes of regal state
Of richest crimson; while, in thorny moss
Enshrined and cradled, the most lovely wear
The hues of youthful beauty's glowing cheek.
2. With fond regret I recollect, e'en now,
In spring and summer what delight I felt
Among these cottage gardens, and how much
Such artless nosegays, knotted with a rush
By village housewife or her ruddy maid,



Were welcome to me ; soon and simply pleased,
 An early worshiper at Nature's shrine,
 I loved her rudest scenes—warrens,² and heaths,
 And yellow commons, and birch-shaded hollows,
 And hedgerows, bordering unfrequented lanes
 Bower'd with wild roses, and the clasping woodbine,
 Where purple tassels of the tangling vetch
 With bittersweet and bryony inweave,
 And the dew fills the silver bindweed's cups :

3. I loved to trace the brooks whose humid banks
 Nourish the harebell, and the freckled pagil ;
 And stroll among o'ershadowing woods of beech,
 Sending in summer from the heats of noon
 A whispering shade ; while haply there reclines
 Some pensive lover of uncultur'd flowers,
 Who from the tumps,³ with bright green mosses clad,
 Plucks the wood sorrel with its light thin leaves,
 Heart-shaped, and triply-folded, and its root
 Creeping like beaded coral ; or who there
 Gathers, the cōpse's pride, anemones,⁴
 With rays like golden studs on ivory laid
 Most delicate ; but touch'd with purple clouds,
 Fit crown for April's fair but changeful brow.

CHARLOTTE SMITH.

¹ FREAK'ED, variegated. [for rabbits, etc.]

² WAR'-REN (*wōr'-ren*), an inclosed place

³ TŪMP, a little hillock.

⁴ A-NEM'-O-NE, the wind flower.

LES. X.—OF TRUTHFULNESS IN ARCHITECTURE.

A. J. DOWNING.



A picturesque elevated country house.

1. If all persons building in the country knew how much the pleasure we derive from rural architecture is enhanced by truthfulness, we should be spared the pain of seeing so many miserable failures in country houses of small dimensions. A cottage—by which we mean a house of small size—will never succeed in an attempt to impose itself upon us as a villa. Nay, by any such attempt on the part of the builder, the cottage will lose its own peculiar charm, which is as great, in its way, as that of the villa.¹

2. This throwing away the peculiar beauty and simplicity of a cottage, in endeavoring to imitate the richness and variety of a villa, is as false in taste as for a person of simple character to lay aside his simplicity and frankness, to assume the cultivation and polish of a man of the world. The basis for enduring beauty is truthfulness, no less in houses than in morals; and cottages, farm-houses, and villas, which aim to be only the best and most agreeable cottages, farm-houses, and villas, will be infinitely more acceptable to the senses, feelings, and understanding than those which endeavor to assume a grandeur foreign to their nature and purpose.

3. The principle which the reason would lay down for the government of the architect in constructing buildings for domestic as well as public life, is the simple and obvious one, that both in material and character they should *appear* to be

what they are. To build a house of wood so exactly in imitation of stone as to lead the spectator to suppose it stone, is a paltry artifice, at variance with all truthfulness. When we employ stone as a building material, let it be clearly expressed; when we employ wood, there should be no less frankness in avowing the material. There is more merit in so using wood as to give to it the utmost expression of which the substance is capable, than in endeavoring to make it look like some other material.

4. A glaring want of truthfulness is sometimes seen in the attempt of ignorant builders to express a style of architecture which demands massiveness, weight, and solidity, in a material that possesses none of these qualities. Such is the imitation of Gothic castles, with towers and battlements built of wood. Nothing can well be more paltry and contemptible. The sugar castles of confectioners and pastry-cooks are far more admirable as works of art. If a man is ambitious of attracting attention by his house, and can only afford wood, let him, if he can content himself with nothing appropriate, build a gigantic wigwam of logs and bark, or even a shingle palace, but not attempt mock battlements of pine boards, and strong towers of thin plank. The imposition attempted is more than even the most uneducated person of native sense can possibly bear.

¹ VIL'-LA, an elegant country seat, or farm, with a mansion and out-houses.

LESSON XI.—BURIAL OF THE DEAD—MONUMENTS OF THE BURIAL-GROUND.

J. A. PICTON.

1. VARIOUS modes have prevailed, in different ages and countries, for the disposal of the remains of the dead, according to the different ideas entertained of the relation between the soul and the body, and the peculiar notions of a future state of existence. Among the Greeks, the custom of burning the dead was nearly, if not quite, universal. The ashes were collected with pious care into an urn, which was deposited in a tomb, sometimes a family vault, with a monument erected over it to the memory of the deceased. Every classical reader will remember the description of the funeral pile of Patroclus, in the twenty-third book of the Iliad:

2.

“Those deputed to inter the slain
Heap with a rising pyramid the plain.
A hundred feet in length, a hundred wide,
The growing structure spreads on every side.
High on the top the manly corse they lay,

And well-fed sheep and sable oxen slay :
 Achilles cover'd with their fat the dead,
 And the piled victims round the body spread."

3. Whatever may be our views of death and a future state, our feelings and sensations on the subject are influenced to a very considerable extent by association; and, unfortunately, the associations which we connect with the final resting-place of the departed have too generally been of the most gloomy, and sometimes of the most terrific description:

4.

"The grave! dread thing,
 Men shiver when thou'rt named: Nature, appall'd,
 Shakes off her wonted firmness. Ah! how dark
 The long extended realms and rueful wastes,
 Where naught but silence reigns, and night, dark night!
 The sickly taper,
 By glimmering through thy low-brow'd murky vaults,
 Furr'd round with misty damps and ropy slime,
 Lets fall a supernumerary horror,
 And only serves to make thy night more irksome."

5. But are these the feelings with which we should look upon the grave? To use the words of an elegant modern writer—Washington Irving—"Why should we thus seek to clothe death with unnecessary terrors, and to spread horrors around the tomb of those we love? The grave should be surrounded by every thing that might inspire tenderness and veneration for the dead, or that might win the living to virtue. It is the place, not of disgust and dismay, but of sorrow and meditation."

6. Death and the grave are solemn and awful realities; they speak with a powerful and intelligible voice to the heart of every spectator, as being the common lot of all, the gate of access to another state of existence through which all must pass. Our cemeteries, then, should bear a solemn and soothing character; they should have nothing in them savoring of fashionable prettiness, nor any far-fetched conceits or tortured allegories; they should be equally remote, in expression, from fanatical gloom and conceited affectation.

7. There are many of our country church-yards, seated deep in the recesses of venerable woods, and shut out, as it were, from the every-day world, which might furnish us models for imitation, as far as calm serenity and quiet beauty go; where the "rugged elms" and "yew-tree's shade," coupled with the "ivy-mantled tower," with which they are connected, give an air of time-honored sanctity to the scene; where no sound reaches the ear but the low murmur of the wind through the summer leaves, or the sighing of the storm through the wintry branches, realizing, if any situation could do so, the description of the poet:

"There is a calm for those that weep,
A rest for weary pilgrims found;
They softly lie and sweetly sleep
Low in the ground."

8. Of the architectural adaptation of monumental structures to the solemnities and consolations of Christian burial, a writer in the *North American Review* makes the following excellent observations :

"There is certainly no place, not even the church itself, where it is more desirable that our religion should be present to the mind than the cemetery, which must be regarded either as the end of all things, the last, melancholy, hopeless resort of perishing humanity, the sad and fearful portion of man, which is to involve body and soul alike in endless night; or, on the other hand, as the gateway of a glorious immortality, the passage to a brighter world, whose splendors beam even upon the dark chambers of the tomb.

9. "It is from the very brink of the grave, where rest in eternal sleep the mortal remains of those whom we have best loved, that Christianity speaks to us in its most triumphant soul-exulting words of victory over death, and of a life to come. Surely, then, all that man places over the tomb should, in a measure, speak the same language. The monuments of the burial-ground should remind us that this is not our final abode; they should, as far as possible, recall to us the consolations and promises of our religion.

10. "But there is a style of architecture which belongs peculiarly to Christianity, and owes its existence even to this religion; whose very ornaments remind one of the joys of a life beyond the grave; whose lofty vaults and arches are crowded with the forms of prophets, and martyrs, and beatified spirits, and seem to resound with the choral hymns of angels and archangels. But peculiarly are its power and sublimity displayed in the monuments it rears over the tomb. The elevated form on which reposes the statue of the mailed knight, or the holy woman, composed into the stately rest of the grave, yet the hands folded over the breast, as if commending the spirit to God who gave it; the canopy which overhangs it; the solemn vault which rises above; the gorgeous windows, through which is poured a flood of golden light upon the abode of the dead—these are the characteristics of the architecture of Christianity, the sublime, the glorious Gothic."

LESSON XII.—THE ARCHITECTURE OF NATURE.

Within the sunlit forest,
Our roof the bright blue sky,
Where fountains flow, and wild flowers blow,
We lift our hearts on high.—ELLIOTT.

1. HAVING dwelt at some length on the fading monuments of man's power, pride, ambition, and glory, and of his daily life, his religious faith, and his burial, it may be well, in closing, to direct our thoughts, in reverent contemplation, to that higher order of architecture every where seen in Nature's works, and full of expression of the power, wisdom, and goodness of the Great Architect.

2. We might speak of the mountains which He has set up

as pillars, and of the overhanging dome which seems to rest on their summits; but in vain we should attempt to describe the vast creations of His handiwork which adorn this magnificent outer temple. Within its walls, however, are sanctuaries, which no "frail hands have made," and where no traces of "man's pomp or pride" are to be seen, but where the humble worshiper, in all the simplicity of childlike faith, may hold communion with his Maker. These are "the groves"—"God's first temples"—whose "venerable columns" "thy hand, our Father, reared."

GOD'S FIRST TEMPLES.

3. The groves were God's first temples. Ere man learn'd
To hew the shaft, and lay the architrave,
And spread the roof above them—ere he framed
The lofty vault, to gather and roll back
The sound of anthems—in the darkling wood,
Amid the cool and silence, he knelt down
And offer'd to the Mightiest solemn thanks
And supplication. For his simple heart
Might not resist the sacred influences
That, from the stilly twilight of the place,
And from the gray old trunks that, high in heaven,
Mingled their mossy boughs, and from the sound
Of the invisible breath, that sway'd at once
All their green tops, stole over him, and bow'd
His spirit with the thought of boundless power
And inaccessible majesty. Ah! why
Should we, in the world's riper years, neglect
God's ancient sanctuaries, and adore
Only among the crowd, and under roofs
That our frail hands have raised? Let me, at least,
Here, in the shadow of this aged wood,
Offer one hymn; thrice happy if it find
Acceptance in his ear.

4. Father, Thy hand
Hath rear'd these venerable columns: Thou
Didst weave this verdant roof. Thou didst look down
Upon the naked earth, and forthwith rose
All these fair ranks of trees. They in Thy sun
Budded, and shook their green leaves in Thy breeze,
And shot toward heaven. The century-living crow,
Whose birth was in their tops, grew old and died
Among their branches; till at last they stood,
As now they stand, massy, and tall, and dark,
Fit shrine for humble worshiper to hold
Communion with his Maker.

5. Here are seen
No traces of man's pomp or pride; no silks
Rustle, no jewels shine, nor envious eyes

Encounter; no fantastic carvings show
 The boast of our vain race to change the form
 Of Thy fair works. But Thou art here; Thou fill'st
 The solitude. Thou art in the soft winds
 That run along the summits of these trees
 In music; Thou art in the cooler breath,
 That, from the inmost darkness of the place,
 Comes, scarcely felt; the barky trunks, the ground,
 The fresh, moist ground, are all instinct with Thee.

6. Thou hast not left
 Thyself without a witness, in these shades,
 Of thy perfections. Grandeur, strength, and grace
 Are here to speak of Thee. This mighty oak—
 By whose immovable stem I stand, and seem
 Almost annihilated—not a prince,
 In all the proud old world beyond the deep,
 E'er wore his crown as loftily as he
 Wears the green coronal of leaves with which
 Thy hand has graced him. Nestled at his root
 Is beauty, such as blooms not in the glare
 Of the broad sun. That delicate forest flower,
 With scented breath, and look so like a smile,
 Seems, as it issues from the shapeless mould,
 An emanation of the indwelling Life,
 A visible token of the upholding Love,
 That are the soul of this wide universe.
7. My heart is awed within me when I think
 Of the great miracle that still goes on
 In silence round me—the perpetual work
 Of Thy creation, finish'd, yet renew'd
 Forever. Written on Thy works, I read
 The lesson of Thy own eternity.
 Lo! all grow old and die; but see, again,
 How, on the faltering footsteps of decay,
 Youth presses—ever gay and beautiful youth—
 In all its beautiful forms. These lofty trees
 Wave not less proudly than their ancestors
 Moulder beneath them.
8. There have been holy men who hid themselves
 Deep in the woody wilderness, and gave
 Their lives to thought and prayer, till they outlived
 The generation born with them, nor seem'd
 Less aged than the hoary trees and rocks
 Around them; and there have been holy men
 Who deem'd it were not well to pass life thus.
 But let me often to these solitudes
 Retire, and, in Thy presence, reassure
 My feeble virtue. Here, its enemies,
 The passions, at Thy plainer footsteps, shrink,
 And tremble, and are still.
9. O God! when Thou
 Dost scare the world with tempests, set on fire

The heavens with falling thunderbolts, or fill,
 With all the waters of the firmament,
 The swift, dark whirlwind, that uproots the woods,
 And drowns the villages; when, at Thy call,
 Uprises the great deep, and throws himself
 Upon the continent, and overwhelms
 Its cities; who forgets not, at the sight
 Of these tremendous tokens of Thy power,
 His pride, and lays his strifes and follies by!
 Oh! from these sterner aspects of Thy face
 Spare me and mine; nor let us need the wrath
 Of the mad, unchain'd elements, to teach
 Who rules them. Be it ours to meditate,
 In these calm shades, Thy milder majesty,
 And to the beautiful order of Thy works
 Learn to conform the order of our lives.—BRYANT.

THE PARTHENON OF ATHENS.

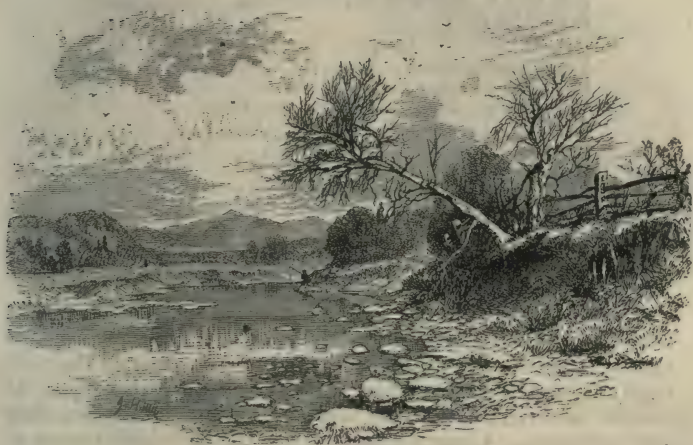
Fair *Parthenon*! yet still must Fancy weep
 For thee, thou work of nobler spirits flown.
 Bright, as of old, the sunbeams o'er thee sleep
 In all their beauty still—and thine is gone!
 Empires have sunk since thou wast first revered,
 And varying rites have sanctified thy shrine.
 Mourn, graceful ruin! on thy sacred hill,
 Thy gods, thy rites, a kindred fate have shared:
 Yet art thou honor'd in each fragment still
 That wasting years and barbarous hands have spared;
 Each hallow'd stone, from rapine's fury borne,
 Shall wake bright dreams of thee in ages yet unborn.

HEMANS.



Front Elevation of the Parthenon, as restored. See also p. 285.

SIXTH MISCELLANEOUS DIVISION.



LESSON I.—INDIAN SUMMER.

1. WHEN was the red man's summer' ?

When the rose
Hung its first banner out' ? When the gray rock,
Or the brown heath, the radiant kalmia clothed' ?
Or when the loiterer by the reedy brooks
Started to see the proud lobelia glow
Like living flame' ? When through the forest gleam'd
The rhododendron' ? or the fragrant breath
Of the magnolia swept deliciously
O'er the half laden nerve' ?

2. No!. When the groves

In fleeting colors wrote their own decay,
And leaves fell eddying on the sharpen'd blast
That sang their dirge'; when o'er their rustling bed
The red deer sprang', or fled the shrill-voiced quail,
Heavy of wing and fearful'; when, with heart
Foreboding or depress'd', the white man mark'd
The signs of coming winter': *then* began
The Indian's joyous season. Then the haze,
Soft and illusive as a fairy dream',
Lapp'd all the landscape in its silvery fold.

3. The quiet rivers that were wont to hide
'Neath shelving banks', beheld their course betray'd
By the white mist that o'er their foreheads crept',
While wrapp'd in morning dreams', the sea and sky

Slept 'neath one curtain', as if both were merged'
 In the same element'. Slowly the sun,
 And all reluctantly, the spell dissolved',
 And then it took upon its parting wing
 A rainbow glory.

4. Gorgeous was the time,
 Yet brief as gorgeous. Beautiful to *thee*,
 Our brother hunter', but to *us* replete
 With musing thoughts in melancholy train.
 Our *joys*, alas'! too oft were *woe* to thee';
 Yet ah! poor Indian', whom we fain would drive
 Both from our hearts, and from thy father's lands',
 The perfect year doth bear thee on its crown',
 And when we would forget', repeat thy name'.—MRS. SIGOURNEY.

LESSON II.—FORGIVENESS OF INJURIES.

1. THE most plain and natural sentiments of equity concur with divine authority to enforce the duty of forgiveness. Let him who has never, in his life, done wrong, be allowed the privilege of remaining inexorable. But let such as are conscious of frailties and crimes consider forgiveness as a debt which they owe to others. Common failings are the strongest lesson of mutual forbearance. Were the virtues unknown among men, order and comfort, peace and repose, would be strangers to human life.

2. Injuries retaliated according to the exorbitant measure which passion prescribes would excite resentment in return. The injured person would become the injurer; and thus wrongs, retaliations, and fresh injuries would circulate in endless succession, till the world was rendered a field of blood.

3. Of all the passions which invade the human breast, revenge is the most direful. When allowed to reign with full dominion, it is more than sufficient to poison the few pleasures which remain to man in his present state. How much soever a person may suffer from injustice, he is always in hazard of suffering more from the prosecution of revenge. The violence of an enemy can not inflict what is equal to the torment he creates to himself by means of the fierce and desperate passions which he allows to rage in his soul.

4. Those evil spirits that inhabit the regions of misery are represented as delighting in revenge and cruelty. But all that is great and good in the universe is on the side of clemency and mercy. The almighty Ruler of the world, though for ages offended by the unrighteousness and insulted by the impiety of men, is "long-suffering and slow to anger."

5. His Son, when he appeared in our nature, exhibited, both in his life and his death, the most illustrious example of forgiveness which the world ever beheld. If we look into the history of mankind, we shall find that, in every age, they who have been respected as worthy, or admired as great, have been distinguished for this virtue.

6. Revenge dwells in little minds. A noble and magnanimous spirit is always superior to it. It suffers not, from the injuries of men, those severe shocks which others feel. Collected within itself, it stands unmoved by their impotent assaults; and with generous pity, rather than with anger, looks down on their unworthy conduct. It has been truly said that the greatest man on earth can no sooner commit an injury, than a good man can make himself greater by forgiving it.

BLAIR.

LESSON III.—PASSING AWAY.

JOHN PIERPONT.

1. Was it the chime of a tiny bell,
 That came so sweet to my dreaming ear,
 Like the silvery tones of a fairy's shell,
 That he winds on the beach, so mellow and clear,
 When the winds and the waves lie together asleep,
 And the moon and the fairy are watching the deep,
 She dispensing her silvery light,
 And he his notes as silvery quite,
 While the boatman listens and ships his oar,
 To catch the music that comes from the shore?
 Hark'! the notes, on my ear that play,
 Are set to words': as they float, they say,
 "Passing away'! passing away'!"
2. But no'; it was not a fairy's shell,
 Blown on the beach so mellow and clear';
 Nor was it the tongue of a silver bell,
 Striking the hour, that fill'd my ear,
 As I lay in my dream'; yet was it a chime
 That told of the flow' of the stream of time'.
 For a beautiful clock from the ceiling hung,
 And a plump little girl, for a pendulum, swung
 (As you've sometimes seen, in a little ring,
 That hangs in his cage, a canary-bird swing);
 And she held to her bosom a budding bouquet,
 And, as she enjoyed it, she seem'd to say,
 "Passing away'! passing away'!"
3. Oh, how bright were the wheels that told
 Of the lapse of time as they moved round slow!

And the hands, as they swept o'er the dial of gold,
Seemed to point to the girl below.

And, lo!— she had changed!; in a few short hours,
Her bouquet had become a garland of flowers,
That she held in her outstretch'd hands, and flung
This way and that, as she, dancing, swung,
In the fullness of grace and womanly pride,
That told me she soon was to be a bride;

Yet then! when expecting her happiest day',
In the same sweet voice I heard her say,
"Passing away! passing away!"

4. While I gazed at that fair one's cheek, a shade
Of thought, or care, stole softly over,
Like that by a cloud on a summer's day made,
Looking down on a field of blossoming clover.
The rose yet lay on her cheek, but its flush
Had something lost of its brilliant blush;
And the light in her eye, and the light on the wheels,
That marched so calmly round above her,
Was a little dimmed, as when evening steals
Upon noon's hot face: yet one couldn't but love her,
For she look'd like a mother whose first babe lay,
Rock'd on her breast, as she swung all day;
And she seem'd in the same silver tone to say,
"Passing away! passing away!"

5. While yet I looked', what a change there came!
Her eye was quench'd', and her cheek was wan':
Stooping and staffed' was her wither'd frame',
Yet just as busily swung she on';
The garland beneath her had fallen to dust';
The wheels above her were eaten with rust';
The hands that over the dial swept',
Grew crooked and tarnish'd, but on they kept';
And still there came that silver tone,
From the shriveled lips of the toothless crone—
Let me never forget to my dying day
The tone or the burden of her lay—
"Passing away! passing away!"

LESSON IV.—THE DREAM OF THE TWO ROADS.

1. It was New-Year's night; and Von Arden, having fallen into an unquiet slumber, dreamed that he was an aged man standing at a window. He raised his mournful eyes toward the deep blue sky, where the stars were floating, like white lilies, on the surface of a clear calm lake. Then he cast them on the earth, where few more hopeless beings than himself now moved toward their certain goal—the tomb.

2. Already, as it seemed to him, he had passed sixty of the stages which lead to it, and he had brought from his journey

nothing but errors and remorse. His health was destroyed, his mind vacant, his heart sorrowful, and his old age devoid of comfort.

3. The days of his youth rose up in a vision before him, and he recalled the solemn moment when his father had placed him at the entrance of two roads—one leading into a peaceful, sunny land, covered with a fertile harvest, and resounding with soft sweet songs; the *other* leading the wanderer into a deep, dark cave, whence there was no issue, where poison flowed instead of water, and where serpents hissed and crawled.

4. He looked toward the sky, and cried out in his agony: "O days of my youth, return! O my father, place me once more at the entrance to life, that I may choose the better way!" But the days of his youth and his father had both passed away.

5. He saw wandering lights floating away over dark marshes, and then disappear. *These* were the days of his wasted life. He saw a star fall from heaven, and vanish in darkness. This was an emblem of himself; and the sharp arrows of unavailing remorse struck home to his heart. Then he remembered his early companions, who entered on life with him, but who, having trod the paths of virtue and of labor were now honored and happy on this New-Year's night.

6. The clock, in the high church tower, struck, and the sound, falling on his ear, recalled his parents' early love for him, their erring son; the lessons they had taught him; the prayers they had offered up on his behalf. Overwhelmed with shame and grief, he dared no longer look toward that heaven where his father dwelt; his darkened eyes dropped tears, and with one despairing effort he cried aloud, "Come back, my early days! come back!"

7. And his youth *did* return; for all this was but a dream which visited his slumbers on New-Year's night. He was still young; his faults alone were real. He thanked God fervently that time was still his own; that he had not yet entered the deep, dark cavern, but that he was free to tread the road leading to the peaceful land, where sunny harvests wave.

8. Ye who still linger on the threshold of life, doubting which path to choose, remember that, when years are passed, and your feet stumble on the dark mountain, you will cry bitterly, but cry in vain: "O youth, return! Oh give me back my early days!"—*From* JEAN PAUL RICHTER.

LESSON V.—THANATOPSIS.

THANATOPSIS is a compound Greek word meaning a *View of Death*; or it may be translated "Reflections on Death."

[The air of pensive contemplation that pervades this piece requires the inflections, in the reading of it, to be slight and gentle, and the tone throughout to be one of tender sadness and Christian resignation.]

1. To him who in the love of nature holds
 Communion with her visible forms, she speaks
 A various¹ language; for his gayer¹ hours¹
 She has a voice of gladness¹, and a smile
 And eloquence of beauty¹, and she glides
 Into his darker musings with a mild
 And healing sympathy, that steals away
 Their sharpness¹ ere he is aware¹.
2. When thoughts
 Of the last bitter hour come like a blight
 Over thy spirit¹, and sad images
 Of the stern agony¹, and shroud¹, and pall¹,
 And breathless darkness¹, and the narrow house¹,
 Make thee to shudder and grow sick at heart¹,
 Go forth unto the open sky, and list
 To Nature's¹ teaching, while from all around¹,
 Earth and her waters¹, and the depths of air¹,
 Comes a still voice—
3. "Yet a few days, and thee,
 The all-beholding sun shall see no more
 In all his course¹; nor yet, in the cold ground,
 Where thy pale form was laid with many tears,
 Nor in the embrace of ocean, shall exist
 Thy image. Earth, that nourish'd thee, shall claim
 Thy growth, to be resolved to earth again;
 And, lost each human trace, surrendering up
 Thine individual being, shalt thou go
 To mix forever with the elements¹,
 To be a brother to th' insensible rock
 And to the sluggish clod¹, which the rude swain
 Turns with his share¹, and treads¹ upon. The oak
 Shall send his roots abroad¹, and pierce thy mould¹.
4. "Yet not to thy eternal resting-place
 Shalt thou retire alone, nor could'st thou wish
 Couch more magnificent. Thou shalt lie down
 With patriarchs of the infant world¹, with kings¹,
 The powerful of the earth¹, the wise¹, the good¹,
 Fair forms¹, and hoary seers of ages past¹,
 All in one mighty sepulchre¹.
5. "The hills,
 Rock-ribbed, and ancient as the sun¹; the vales,
 Stretching in pensive quietness between¹;
 The venerable woods¹; rivers that move

In majesty, and the complaining brooks
 That make the meadows green'; and, pour'd round all',
 Old ocean's gray and melancholy waste
 Are but the solemn decorations all
 Of the great tomb of man. The golden sun',
 The planets', all the infinite host of heaven',
 Are shining on the sad abodes of death,
 Through the still lapse of ages.

6. All that tread
 The globe are but a handful to the tribes
 That slumber in its bosom. Take the wings
 Of morning', and the Barcan desert pierce',
 Or lose thyself in the continuous woods
 Where rolls the Oregon', and hears no sound
 Save his own dashings'—yet the dead are there';
 And millions in those solitudes, since first
 The flight of years began', have laid them down
 In their last sleep': the *dead* reign there alone.
7. So shalt *thou*' rest; and what if thou shalt fall
 Unnoticed by the living', and no friend
 Take note of thy departure'? All that breathe
 Will share thy destiny. The gay will laugh
 When thou art gone'; the solemn brood of care
 Plod on'; and each one, as before', will chase
 His favorite phantom'; yet all these shall leave
 Their mirth and their employments, and shall come
 And make their bed with thee. As the long train
 Of ages glides away', the sons of men',
 The youth in life's green spring', and he who goes
 In the full strength of years', matron and maid',
 The bow'd with age', the infant in the smiles
 And beauty of its innocent age cut off',
 Shall, one by one', be gather'd to thy side',
 By those who, in *their* turn', shall follow them'.
8. So live that when thy summons comes to join
 The innumerable caravan that moves
 To the pale realms of shade', where each shall take
 His chamber in the silent halls of death',
 Thou go not like the quarry-slave at night,
 Scourged' to his dungeon'; but, sustain'd and soothed
 By an unflinching trust, approach thy grave
 Like one who wraps the drapery of his couch
 About him', and lies down to pleasant dreams'.—BRYANT.

LESSON VI.—THE VILLAGE BLACKSMITH.

LONGFELLOW.

1. UNDER a spreading chestnut-tree
 The village smithy stands,
 The smith, a mighty man is he,
 With large and sinewy hands;

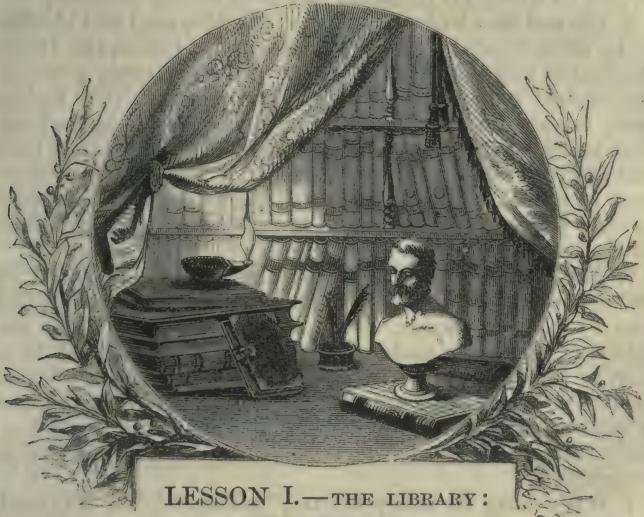
And the muscles of his brawny arms
Are strong as iron bands.

2. His hair is crisp, and black, and long;
His face is like the tan;
His brow is wet with honest sweat;
He earns whate'er he can,
And looks the whole world in the face,
For he owes not any man.
3. Week in, week out, from morn till night,
You can hear his bellows blow;
You can hear him swing his heavy sledge
With measur'd beat and slow,
Like a sexton ringing the village bell,
When the evening sun is low.
4. And children coming home from school
Look in at the open door;
They love to see the flaming forge,
And hear the bellows roar,
And catch the burning sparks that fly
Like chaff from a threshing-floor.
5. He goes, on Sunday, to the church,
And sits among his boys;
He hears the parson pray and preach,
He hears his daughter's voice,
Singing in the village choir,
And it makes his heart rejoice.
6. It sounds to him like her mother's voice,
Singing in Paradise!
He needs must think of her once more,
How in the grave she lies;
And with his hard, rough hand he wipes
A tear out of his eyes.
7. Toiling, rejoicing, sorrowing,
Onward through life he goes;
Each morning sees some task begun,
Each evening sees it close,
Something attempted, something done,
Has earn'd a night's repose.
8. Thanks, thanks to thee, my worthy friend,
For the lesson thou hast taught!
Thus, at the flaming forge of life,
Our fortunes must be wrought;
Thus, on its sounding anvil, shaped
Each burning deed and thought.

PART VII.

SECOND DIVISION OF NATURAL PHILOSOPHY.

[This subject is continued from the Fourth Reader.]



LESSON I.—THE LIBRARY: INTRODUCTORY.

1. "WELCOME to the hills and dales of Glenwild," said Mr. Maynard, as he met for the first time, after a short vacation, the Volunteer Philosophy Class, composed of Masters George, John, and Frank, and Misses Ida and Ella. "Welcome to the pleasant shade of the spreading oak, to the lawn, the grove, the meadow, 'The River;' but especially to the LIBRARY and recitation-room, endeared by the memories of the past, and where we hope to talk over the remaining topics of philosophy. But tell me first how you have spent the vacation."

2. After a short pause, John, who was the eldest of the class, replied that he had passed the brief month about his father's mill, where he had felt the advantage of the scientific knowledge he had gained, and his need of more.

3. George had contrived a new arrangement of levers to remove stumps of trees from his father's farm, and had also

made a whippetree in such a way that a weak horse could plow with a strong and able one without having to pull more than one third as much as the other.

4. Frank had passed his vacation in the city, but not unmindful of the lessons he had learned at Glenwild. His philosophical experiments had been principally confined to rowing and sailing; and the best possible rig for his boat was the subject to which his thoughts had been chiefly directed.

5. Ida and Ella had accompanied Mr. Maynard and his family in their vacation tour to Niagara, the Lakes, the White Mountains, and the sea-side. They had seen many practical illustrations of those laws of philosophy which they had already learned; and while they were not less delighted and enraptured with the sublime and picturesque objects of their visit than the most poetical tourists, they still had many questions to ask about *rainbows, clouds, waves, and winds*—phenomena which Mr. M. promised to explain more fully on their return to Glenwild.

6. Mr. Maynard told them that he well remembered his promise, and that the remaining departments of Natural Philosophy related to water, winds, clouds, rainbows, thunder and lightning, and other similar phenomena. It would not, however, be possible to give them all the instruction they would need on so many and important subjects in the time devoted to philosophy; but he had made arrangements to explain many things about them in a course of lessons on Physical Geography.

7. "We have to study matter," remarked Mr. Maynard, "in its three forms or conditions. All material substances are either *solids, liquids, or gases*. Many substances—perhaps all—may exist in all three of these forms, under proper conditions of temperature and pressure; as *steam*, which may be condensed into *water* or frozen into *ice*. Even metals may be melted, and then converted into vapor.

8. "There are two conditions or aspects in which all these forms of matter should be considered, viz., in a state of *rest* and in *motion*; the former of which is treated under the head of *statics*, and the latter under that of *dynamics*. The Lessons on Philosophy in the Fourth Reader were on the statics and dynamics of *solids*; and our present course will treat of the corresponding laws of *liquids* and *gases*."

9. "I would like to ask," said Frank, "if the allotment of the empire of the world, in ancient mythology, to the three brothers, Jupiter, Neptune, and Pluto, had any reference to

the three forms of matter of which the world is composed."

"It is not improbable," replied Mr. Maynard, "that this distribution of authority by the ancients was their mysterious way of exhibiting the truth which seems so plain to us. Jupiter and his wife Juno had special direction of atmospherical phenomena, such as thunder and lightning, wind, clouds, snow, and rainbows. Homer says the portion which fell to Jupiter was the 'extensive heaven in air and clouds.'"

10. "I recollect reading," said Frank, "that Jupiter was also called Zeus,¹ and that in old times the expression, 'What is Zeus doing?' was equivalent to 'What kind of weather is it?'"

"I would also remind you," continued Mr. Maynard, "that Neptune was the god of water in general, but especially of the sea, rivers, and fountains. Pluto's abode was in the solid earth; and his name, which in Greek means riches or wealth, indicates his supremacy over the solid forms of matter. Thus we see that Frank's question was quite appropriate; and the three forms of matter were evidently represented in this mystical manner by the wisest men of former times."

11. "I think," said Frank, "that they call *rich* men *solid* men in our day, which is most appropriate, as Pluto was the same as wealth, and had charge of the solid part of matter."

"I do not think the *solid* men will thank you for your etymological discovery," said Ida. "It is certainly more fanciful than philosophical," said Mr. Maynard, who then proceeded to assign the subject of HYDROSTATICS for the next lesson.

¹ ZEUS, the Greek name for Jupiter, pronounced in one syllable, as zūs.

LES. II.—HYDROSTATICS, OR LIQUIDS IN A STATE OF REST.

1. *Mr. M.* As, in our lesson on the statics¹ of solids, the knowledge of a few principles and definitions enabled you to solve many problems of apparent difficulty, so in the statics of liquids, or *hydrostatics*,² you may expect to do the same by the same means. The first thing necessary is a definition of the term *fluid*.

2. *Ida.* I looked in Webster's Dictionary for a definition, and found it to be "any substance whose parts easily move and change their relative position without separation, and which yields to the slightest pressure."

3. *John.* Is not every thing *fluid* that is not *solid*?

Mr. M. Yes, every thing is either *solid* or *fluid*. Water and air are both *fluids*, but they are not both *liquids*. Will George define the term *liquid*?

4. *George.* I took pains to look in Webster's Dictionary also for the term. I found it to be "a fluid or flowing substance; a substance whose parts change their relative position on the slightest pressure, and which flows on an inclined plane." I can not understand from this the difference between a *fluid* and a *liquid*.

5. *Mr. M.* All liquids are fluids, but all fluids are not liquids. Those fluids which tend to expand when at liberty, as air and gases, retain their name, and are properly called fluids; but such as do not so expand are commonly called liquids, as water, oil, and mercury. Many phenomena show that both *attractive* and *repulsive forces* exist between the particles which compose the mass of a body. When the attractive force is predominant, the body is a *solid*. When the two forces balance, the body is a liquid; and when the repulsive force predominates, the matter is a gas. In the last-named case the particles tend apart, so that some external force is required to keep them together. It is very important to keep these distinctions in mind, if you would understand the appearances you will be called upon to explain. Will John now inform us what is the most noticeable property of water after its fluidity?

6. *John.* I think every person must have observed the level surface of water when it is at rest. I have often heard people talk of a water-level.

Mr. M. The earth, you know, is spherical, or nearly so; and as three fourths of its surface are covered with water, it is evident that the water-level conforms to the shape of the earth, which has a convex surface. This deviation from a plane, or a straight line, is found to be eight inches in one mile. Do you know what it would be for two miles?

7. *Frank.* I suppose it must be sixteen inches, and so on for any distance.

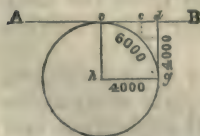


Fig. 1, showing the variation of the curve from the straight line A B.

John. There must be some mistake here; for I once stood on the ice, and with a good spyglass I could see an object at the very water's edge, and only three miles distant.

8. *Ella.* If Frank is correct, in four thousand miles, the straight line would vary from the earth's curvature only four

thousand times eight inches, or about half a mile; when it is plain that the variation must be as much as the earth's radius, or four thousand miles instead of half a mile! a wonderful difference.

Mr. M. I think Frank must see that he is mistaken.

9. *Frank.* I am very sure it was so stated in the Philosophy I studied, but I see it can not be right.

Mr. M. The distance the straight line varies from the curve may be found, *for short distances*, by multiplying the square of the distance in miles by eight inches. Now can Frank tell the deviation for two miles?

10. *Frank.* The square of two is four; and four, multiplied by eight, gives thirty-two inches, which must be the deviation for two miles.

Mr. M. You have now given a correct reply. If John had been six feet in height, he could have seen just three miles on the ice of a lake, as you will see by reversing the process I gave you. Will John show how to do it?

11. *John.* Six feet are seventy-two inches, which, divided by eight, gives nine for a quotient, and the square root of nine is three, which is miles.

Mr. M. As you may have occasion to put such calculations into practice, I would request you to notice that *the difference between the true and apparent level varies as the square of the distance* for any distance that can occur in leveling.

12. *Ida.* I think the engineers of the Erie Canal must have had occasion to put that rule into practice when they gave the levels to the workmen who constructed it.

Mr. M. I am glad so important a matter can be so interesting to you. Are you aware that water will rise to the same level when in different vessels which have a communicating pipe between them?

John. I have often seen such a result. Is not that the principle on which water is distributed in cities?

13. *Mr. M.* In most of our large cities, water is conveyed into the upper stories of houses by this very principle. Water will rise to the level of its source, whether the pipes are of cast iron or porous strata of the earth. In this way water is obtained in many places by boring wells two thousand feet or more in depth. The water which fell as rain on some distant mountain, and which was slowly making its subterranean way hundreds of feet below the surface, rises where an opening is made to supply the necessities of man on the otherwise arid plain.

14. *George*. Are not these called Artesian wells? I have read of several recently bored in the Sahara Desert.

Mr. M. The inhabitants of the oases where these wells have been bored were wild with delight and wonder as they saw the water rush forth from the dry sands; and they have given them such names as "the well of bliss," "the well of gratitude," etc.

15. *John*. I do not wonder the wandering tribes of the desert believed that the French, who bored the wells, had wrought a miracle. To them it was a miracle; but to us, only water rising to its level, as we see every day in a tea-kettle.



Fig. 2.

16. *Ida*. I have just read a verse from Eliza Cook's poems which I will repeat:

" Traverse the desert, and then ye can tell
What treasures exist in the cold deep well;
Sink in despair on the red parched earth,
And then ye may reckon what water is worth."

17. *Mr. M.* It is thought that these wells will work a great social revolution in those regions. The various tribes, instead of wandering, like their ancestors, from one place to another, will settle around these fertilizing springs, and begin to cultivate the earth even in those sandy deserts. Artesian wells have been bored in Charleston, S. C., St. Louis, Mo., Columbus, O., La Fayette, Ind., Louisville, Ky., and many other places in this country. In Alabama they are of incalculable value, and are very numerous on plantations and in villages.

18. The annexed cut of a *vertical* section of the earth's crust shows the principle of the Artesian well.

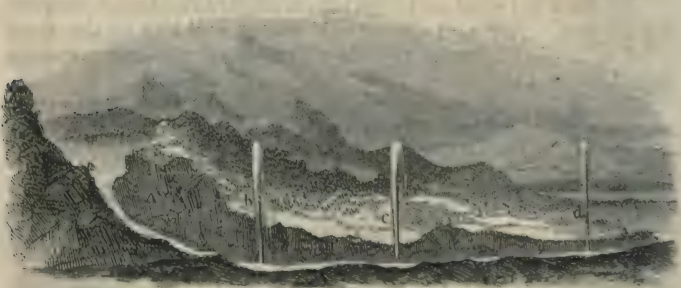


Fig. 3, the theory of Artesian wells.

The stratum A, and the one below it, are impervious to water, but between them is a fissure or seam along which the water penetrates from the lake on the hills. Wells are bored

in the valley through which the water rises with great force as soon as the boring enters the fissure between the strata. The water may be carried up in pipes to the very level of the lake.

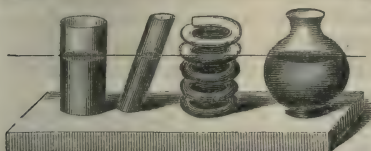


Fig. 4, water finding its level in differently-shaped vessels that communicate with each other.

19. *John*. Really these wonderful wells show, on a large scale, the experiment of water finding its level in differently-shaped vessels which have free communication by a tube at the bottom.

Mr. M. In our next lesson I hope to finish what we shall have to say on Hydrostatics.

¹ STÁT'-ics, from the Greek *statike* (στατική), "rest," or "stand still:" the science which treats of the forces which keep bodies at rest, or in equilibrium.

² HY-DRO-STÁT'-ics, from the Greek *hudōr* (ὕδωρ), "water," and *statike*: the science which treats of the properties and pressure of fluids at rest.

LESSON III.—HYDROSTATICS—*Continued.*

1. "I WILL introduce the subject for this lesson," said *Mr.*

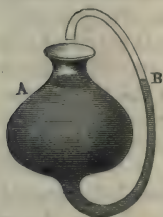


Fig. 5, an ounce of water balances a pound.

M., "by showing you one of the ways in which an ignorant contriver tried to obtain a constant flow of water—a kind of perpetual motion—by means of a vessel like this.

"He reasoned thus: A *pound* of water in *A* must more than balance an *ounce* in *B*, and must therefore be constantly pushing the ounce forward into *A* again, thus causing a constant flow of water in continuous current.

What think you of his success?"

2. *Ella*. I think he found the water to rise no higher in *B* than in *A*.

Mr. M. You think correctly. You must see that as the downward pressure in *B* is equal to that in *A*, the pressure of water is by no means as the *mass*, but as the *vertical height* of the fluid.

George. I have been reading about this hydrostatic paradox—how any quantity of water, however small, may balance any quantity, however great. I think I see how it is, as the tube may be very small, and the vessel with which it communicates very large, and the water will

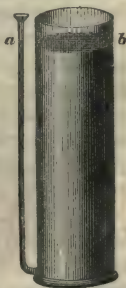


Fig. 6, the water in *a* balances the whole mass in *b*.

stand at the same level in both. Fig. 6 therefore seems to illustrate the same principle as Fig. 5—the water in the pipe *a* balancing the whole mass in *b*.

3. *Ida*. I now understand what has always been a mystery to me: I mean the experiment with the hydrostatic bellows, where a boy can raise himself, as shown in the figure in this book, by standing on a bellows, and pouring water into the small tube which is connected with it.

Mr. M. What is the statement in the case there given?



Fig. 7, the Hydrostatic Bellows.

4. *Ida*. It is stated that the water in the small pipe, or tube, having a vertical height of three feet, and a surface area of one inch, will balance a column in the bellows, with which it is connected, of the same height, and of any area, however great. In the case here represented, as the bellows has an area of two feet, the water in the small pipe, weighing a little more than a pound and a quarter, will support a column of water in the bellows of two square feet in area and three feet in height, or a weight of about three hundred and seventy-four pounds.

5. *Mr. M.* Very well. Now let me ask George a question. If a tightly-fitting piston should be inserted in the top of the small pipe, and a man weighing one hundred and fifty times as much as the water in the pipe should get on the top of the piston, what additional amount of upward pressure do you suppose he would thereby exert on the top board of the bellows?

6. *George*. Evidently, from the principle stated, he would exert an additional pressure of one hundred and fifty times three hundred and seventy-four pounds, which would be equal to fifty-six thousand and one hundred pounds, or a little more than *twenty-eight tons*! This certainly beats the power of the levers which I planned for pulling up stumps!

Ida. And it is stated that if the area of the bellows were ten times greater, or the force applied to the piston ten times greater, a weight ten times heavier would be raised on the bellows!

7. *Frank*. I do not see any limit to the power of a machine constructed on this principle; for if the area of the top of the bellows were one thousand feet instead of two feet, the power of this same machine, with the weight of the man on the piston, would be equal to a pressure of more than *fourteen thousand tons*!

8. *George*. Yes; and if the small tube were no bigger than a pipe-stem, the bellows would sustain just as great a weight.

Mr. M. There is, indeed, no limit to the power of such a machine, except the strength of the material of which it is made.

John. Was the press used by Mr. Stephenson in raising the tubes of the Britannia Bridge, which weighed fifteen hundred tons each, constructed on this principle?

9. *Mr. M.* Yes. Mr. Stephenson had presses made which weighed forty tons each. The cast-iron of the cylinders was eleven inches thick; and it was estimated that if one of these presses were used as a forcing-pump, it would be capable of throwing water, in a vacuum, five and a half miles high.

10. *Frank*. Was it necessary to make the cylinders so thick?

Mr. M. Thick as they were, one of them suddenly burst, throwing off a piece of iron weighing a ton and a half.

Ida. I do not wonder this is reckoned one of the most powerful existing machines, and that when Mr. Brunel had to launch the Great Eastern, weighing twelve thousand tons, he resorted to the hydraulic press.

11. *Mr. M.* Mr. Brunel used a large number of these powerful presses; and so great was the pressure put upon them that the water was forced through the pores of the thick iron cylinders, and stood like dew on the outside.

George. And I recollect that some of the men standing near said those presses had to work so hard that it *made them sweat*.

12. *John*. As the power of this hydraulic press is so tremendous, why is it not used to propel machinery?

Mr. M. I think you yourself could answer that question if you would refer to the principle illustrated in the Lessons on Mechanical Powers in the Fourth Reader. You there learned that, in all machinery, "what is gained in *power* is lost in *velocity*." If a pressure of one pound exerted on a piston placed in the small tube, in Fig. 7, should press the piston down one foot, and exert a pressure of a thousand pounds on the top board of the bellows, *how much* would it raise the board?

13. *John*. I understand now the application of the principle; for it is very evident that a downward movement of the piston to the extent of *one* foot would result in an upward movement of the top board of the bellows of only the *thousandth part* of a foot!

Ella. How beautifully this illustrates the law of *compensation* which is said to pervade all nature!*

14. *John.* Does it not appear, from the principles already illustrated, that the pressure of a column of water is proportionate to its height and base?

Mr. M. Yes; its vertical height. If we fill with water a small vertical tube, twenty-four feet in height, and having the horizontal area of its orifice equal to one square inch, it is very plain that the water will press upon the base or bottom with its own weight, which is a little more than ten pounds. But if the base be enlarged, so that the water shall then cover an area of ten square feet, what will the pressure be on the *entire* base?

15. *George.* I think I can tell, for the *principle* has already been explained. We shall get the entire pressure by multiplying the entire area of the base—that is, its whole number of square inches—by the pressure on one square inch.

John. I have made the calculation; and I find the pressure on the entire base would be fourteen thousand and four hundred pounds, or more than *seven tons!*

Ella. I see, by the diagram, Fig. 9, that all the water in the vessel need not weigh more than twelve pounds; how then is it possible that it can press on the bottom of the vessel with a force of more than *seven tons?*

16. *Mr. M.* And yet, strange as it may appear, such is the fact; the pressure of the water in the vessel is the same in all directions, upward as well as downward; it is the same on every square inch; and if the vessel could not yield any without breaking, it would require a very strong material to



Fig. 9.

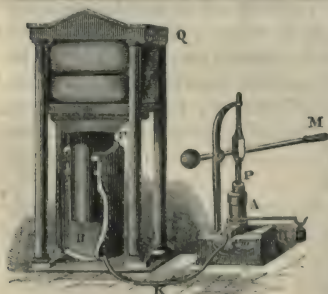


Fig. 8, the Hydraulic Press.

* The hydraulic press, as used for practical purposes (as for pressing bales of cotton, etc.), is illustrated in the accompanying figure. It is connected with a forcing-pump, which raises the water from the reservoir H, and then forces it through the tube K into the large cylinder B. Here the water acts to raise the large piston P. If the area of the base of the small piston is a square inch in diameter, and the area of the base of the large piston P is one thousand square inches, then a downward pressure of one pound on the one will exert an upward pressure of one thousand pounds on the other. But it must be recollected that the small piston must move downward through the space of a *thousand* inches, while the large piston rises only *one* inch. By means of this machine cotton is pressed into bales, ships are raised for repairs, chain-cables are tested, etc., etc.

withstand the pressure. But you can see that a *very little* yielding of the top or bottom of the vessel would lower the water in the tube so as greatly to relieve the pressure. Yet if the vessel *should* yield, by continuing to pour water into the tube, a very strong vessel might thus be broken.

17. *George*. I now recollect seeing statements of the bursting of hills, and even of mountains, by the force of the water which had accumulated within them. Was this on the principle of the hydrostatic pressure which we have been considering?

Mr. M. It was. In mountainous regions this principle is sometimes exhibited on a grand scale, and whole villages have been buried by these hidden powers of nature. This diagram will illustrate the principle.

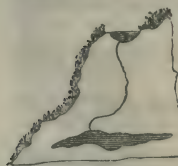


Fig. 10.

18. *Ella*. But the channel which leads to the basin of water in the mountain is not *vertical*. Does this make any difference?

Mr. M. When this is the case, the pressure is estimated by the vertical distance from the level at the top to the basin. But I see our time is exhausted. In conclusion, however, I will state the rule (the principle of which you have already discovered) for the pressure of fluids. It is this:

*Multiply the area of the base, in feet, by the perpendicular depth of the water, and this product by the weight of a cubic foot of water: or the numbers may be inches throughout.**

LESSON IV.—FLOATING BODIES—SPECIFIC GRAVITY.

1. "As Master Frank was so much interested in *boats* during his vacation," said Mr. Maynard, "I suppose he will feel a corresponding interest in the theory of their *flotation*."

Frank. I hope I have not shown any want of interest in

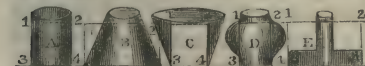


Fig. 11, the pressure is as the height multiplied by the base.

* The accompanying diagram well illustrates the principle of hydrostatic pressure. Here are five vessels, differing in shape, but equal in capacity. The pressure of the water upon the bottom of each is found by multiplying the vertical height by the extent

of surface of its base, thereby indicating different amounts of pressure.

The weight of a cubic inch of water, of the common temperature of 62 degrees, is a portion of a pound expressed by the decimal 0.036065. The pressure of a column of water one foot high, having a square inch for its base, will be twelve times this, or, 0.4328 lbs. The pressure, therefore, produced upon a square foot by a column one foot high, will be found by multiplying this last number by 144, and will be 62.3232 lbs.

previous lessons; but I confess that this is to me an entertaining subject.

2. *Mr. M.* Ever since Jason¹ built the Argo, the theory of floating bodies has been a most entertaining and important study. The poet Horace said *that* mortal's heart was cased

"In oak or brass, with triple fold,
Who first to the wild ocean's rage
Launched the frail bark."

3. *Ida.* Frank must have been very brave to have dared the raging waves of the harbor in *his* "frail bark." I confess I never get into a small boat without fear, but I hope to learn something in this lesson that will give me more confidence when on the water.

4. *Mr. M.* Have you thought of the conditions under which a body will float or sink?

Frank. It will *float* if *lighter* than water, and *sink* if *heavier*.

Mr. M. That is very true; but it is necessary to understand that a floating body displaces a quantity of water equivalent in weight to the body itself, as may be proved by experiment.



Fig. 12, the principle of specific gravity.

Let the vessel A be filled with water till it runs out of the spout; if you then place on the surface of the water a wooden ball, a quantity of water will flow out, which will *weigh* the same as the ball. If an iron ball had been used, the water overflowing would have been equal in *bulk* to the ball.

5. *John.* Would not that be a convenient way to measure the solidity of an irregular body, as a fragment of stone?

George. It would be an excellent way to detect a counterfeit gold coin.

Ella. I would like to find a method of detecting spurious gold money. Do explain it.

6. *George.* Counterfeit gold coins are either too large or too light. If too light, the common balance will show it; but if too large, the quantity of water displaced will be more than if genuine. This can be carefully measured in a small glass.

Mr. M. This brings us directly to the subject of *specific gravity*. Can either of you give a concise definition of *specific gravity*?

7. *John.* I have learned from the book on Natural Philosophy which I have been studying, that the specific gravity of

a body is its weight, compared with the weight of an equal bulk of pure water—water being taken as a standard.

Mr. M. Can you tell me, then, how the specific gravity of a solid heavier than water is ascertained?

8. *George.* Weigh it first in air, and then in water. Divide the weight in air by the loss in water, the quotient will be the specific gravity of the body. Thus, if a solid weigh twenty pounds in the air and eighteen pounds in water, its specific gravity is *ten*; that is, it is ten times heavier than water.

Ida. Is it of much use to find the specific gravity of bodies?

9. *Mr. M.* I will give you an example of its use, and let you judge for yourself of its importance. I have heard you express a doubt as to the value of the silver cup you obtained as a prize at the Union Seminary. As it becomes tarnished so easily, you fear it is not real silver. If it is alloyed, it will probably be lighter than standard silver, which has a specific gravity of 10.47; that is, silver is nearly ten and a half times heavier than water. Can either of you find the specific gravity of the cup which *Ida* has gone to bring for examination?



Fig. 13, to find the specific gravity of a solid.

10. *John.* Now I have the cup I will carefully weigh it. It weighs five and a half ounces in the air. I will now suspend it by a thread in water, and find how much less it will weigh. It has lost ten and a half pennyweights. I find, by dividing the weight in air by the loss in water, that the specific gravity of the cup is 10.47, which shows it to be made of

standard silver.

Ida. I am glad my suspicions were unfounded; and now I recollect they were first suggested by one of the disappointed competitors.



Fig. 14, the Hydrometer.

11. *Mr. M.* It is a pity we have no way to remove your new suspicions of the motive of your rival. I have here a chain, bought for gold, which by chemical tests shows copper in its composition. It weighs two ounces, or forty pennyweights, in air, and thirty-seven pennyweights in water, from which I find the copper to be about three eighths of the whole weight. There is a very convenient instrument, called the hydrometer,* for finding the specific gravity of liquids.

* The hydrometer, figure 14, consists of a hollow ball, B, with a long, slender, graduated stem, A D; and the ball is so loaded by a weight, C, that the stem will stand upright in water. The lighter the fluid, the greater the depth to which the hydrometer will sink.

Who can give me an account of the manner in which the principle of specific gravity was first discovered?

12. *Ida*. I have purposely brought a book containing an account of the discovery, which, with your permission, I will read. The article is entitled

ARCHIMEDES AND THE CROWN.

"King Hiero of Syracuse, or his son Gelon, it seems, had given out a certain amount of gold to be made into a crown, and the workman to whom it had been intrusted had at last brought back a crown of corresponding weight. But a suspicion arose that it had been alloyed with silver, and Archimēdes was applied to by the king either to disprove or to verify the allegation. The great problem, of course, was to ascertain the precise bulk of the crown in its existing form; for, gold being so much heavier than silver, it is obvious that if the weight had been in any degree made up by the substitution of silver, the bulk would be proportionately increased. Now it happened that Archimēdes went to take a bath while this problem was exercising his mind, and, on approaching the bath-tub, he found it full to the very brim. It instantly occurred to him that a quantity of water of the same bulk with his own body must be displaced before his body could be immersed.

13. "Accordingly, he plunged in; and while the process of displacement was going on, and the water was running out, the idea suggested itself to him that, by putting a lump of gold of the exact weight of the crown into a vessel full of water, and then measuring the water which was displaced by it, and by afterward putting the crown itself into the same vessel after it had again been filled, and then measuring the water which this, too, should have displaced, the difference in their respective bulks, however minute, would be at once detected, and the fraud exposed. 'As soon as he had hit upon this method of detection,' we are told, 'he did not wait a moment, but jumped joyfully out of the bath, and, running toward his own house, called out with a loud voice that he had found what he had sought. For, as he ran, he called out in Greek, "*Eurēka, Eurēka!*" "I have found it, I have found it."

14. "No wonder that this veteran geometer, rushing through the thronged and splendid streets of Syracuse, and making the welkin ring with his triumphant shouts—no wonder that he should have rendered the phrase, if not the guise, in which he announced his success, familiar to all the world, and that '*Eurēka, Eurēka,*' should thus have become the proverbial ejaculation of successful invention and discovery in all ages and in all languages, from that day to this! The solution of this problem is supposed to have led the old philosopher not merely into this ecstasical exhibition of himself, but into that line of hydrostatical investigation and experiment which afterward secured him such lasting renown. And thus the accidents of a defective crown and an overflowing bath-tub gave occasion to some of the most remarkable demonstrations of ancient science."

15. "That account," said *Mr. M.*, "which I perceive you have taken from a lecture of the Hon. Robert C. Winthrop on

The scale should be so graduated that when the hydrometer is immersed in pure water at the standard temperature, it may sink to the point which is marked 1. Then, when the hydrometer is immersed in any other liquid, the figure on the scale to which it sinks will show the specific gravity of that liquid. When the quantity of liquid is too small to float the hydrometer, other methods are used.

Archimēdes and Franklin, is indeed a history of one of the most important events in the records of science. In that same lecture is a very interesting account of the visit of the Roman orator Cicero to the grave of the philosopher."

¹ JA'-SON, the hero of the famous *Argonautic Expedition*, as fabled in Grecian history, sailed in the ship *Argo* to Colchis, in Asia Minor, for the purpose of recovering a "golden fleece" deposited there.

LESSON V.—HYDRAULICS—THE EXCURSION.

SONG OF THE BROOK.

1. I COME from haunts of coot¹ and hern ;²
I make a sudden sally,
And sparkle out among the fern,
To bicker³ down a valley.
2. By thirty hills I hurry down,
Or slip between the ridges;
By twenty thorps,⁴ a little town,
And half a hundred bridges;
3. I chatter over stony ways
In little sharps and trebles,
I bubble into eddying bays,
I babble on the pebbles.
4. And out again I curve and flow,
To join the brimming river;
For men may come, and men may go,
But I go on forever.—TENNYSON.

5. "The day is so pleasant, and the subject of our lesson so inviting," said Mr. Maynard, "I propose a walk by 'The River,' where we can better witness some experiments appropriate to our studies. You know that, in plain English, the lesson to-day is about *water in motion*."

6. "I shall be delighted," said Ida, as they were crossing the lawn, "to study this lesson in the pleasant valley; for I had feared it would be all about mills and resistances of fluids—important enough for millwrights and engineers, but of little interest to Ella and myself. Now I shall ramble where

'Joy smiles in the fountain, health flows in the rills,
And the ribbons of silver unwind from the hills.'"

7. *Ella*. I really fear that Ida and I will learn but little philosophy in this lovely valley, "where streamlets flow and wild flowers blow." Ida, let us study the poetry of the subject *first*.

"How beautiful the water is!
To me 'tis wondrous fair—
No spot can ever lonely be
If water sparkle there;
It hath a thousand tongues of mirth,
Of grandeur, or delight,
And every heart is gladder made
Where water greets the sight."

8. *Mr. M.* I am glad you will all enjoy this topic, and that

the girls can talk about "ribbons of silver," while the boys are discussing the merits of undershot and overshot wheels; but I shall be disappointed if you do not find that the very poetry of "water in motion" is full of philosophy, and that the philosophy is very poetical. You can all moralize on the subject, also, as you see

"The rivers, how they run
Through woods and meads, in shade and sun,
Sometimes swift, sometimes slow,
Wave succeeding wave, they go
A various journey to the deep,
Like human life, to endless sleep."

I think we will continue along "The River" as far as Rocky Glen, where is a fine well of water, with an old-fashioned *sweep*; and then, if the girls are not too much fatigued, we will follow the glen, and go up to the *Cascades*, where, as George will recollect, are the remains of an old mill.

9. *George*. I have been there frequently, and a wild but beautiful spot it is, too.

Ida. I have heard so much about the *Cascades*, I know I shall be delighted to see them. I am sure Ella and I can easily walk as far as that and back again.

Mr. M. As we shall have this running stream constantly "babbling" to us, with its "thousand tongues of mirth," as Ella said, let me ask how it is that it has this *speaking* power?

John. By its *motion*, I suppose.

10. *Mr. M.* Then tell me, if you please, what makes the water move at all?

John. The bed of the river is an inclined plane, and the particles of water roll down by the force of gravity, just as a marble from a desk.

Mr. M. Very well; this force of gravity is such that, in large rivers, a fall of three inches in a mile is said to give a velocity of three miles an hour.

George. Would it not be the same in small streams?

11. *Mr. M.* By no means. The friction of the water against the banks and bottom tends to retard the motion. In pipes the friction is so great that, in a tube one inch in diameter and two hundred feet long, only one fourth as much water will be discharged as would escape from a simple aperture of the same size.

Frank. I see the river is much wider in some places than in others. Is not the current the most rapid in the narrowest parts?

12. *Mr. M.* It is. I have here an instrument called a stream-measurer. It consists of a vertical tube with a trumpet-



Figure 15, the
Stream-meas-
urer.

shaped extremity, bent at a right angle. When plunged in motionless water the level in the tube corresponds with that outside, but the impulse of a stream causes the water to rise in the tube until its vertical pressure counterpoises the force. Let us try it first in the wide, and then in the narrow places. You see quite a difference in the velocity.

13. *George*. I have just thrown some pieces of bark, one near the middle, and the other near the shore. See how much faster the piece near the middle goes down stream.

Ida. Before I came to Glenwild I lived in sight of a navigable river, and I used to wonder why the boats, in descending, kept near the middle, and those ascending went nearer the shore. I understand it now. Boats going down had more assistance from the current, and those coming up had less resistance.

14. *Mr. M*. There is also a greater velocity at the surface than near the bottom from the same cause.

John. I think I see why wide rivers are higher in the middle than near the banks. The water, running more swiftly, tends to draw along that on each side of it, which it can not do without lowering the surface on each side.

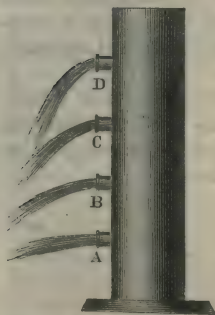


Fig. 16, the velocity of spouting water.

15. *Mr. M*. You must not confound the velocity at the surface of a river, and at different depths, with that of water running from apertures in a reservoir. If in this vessel, Fig. 16, orifices be made at different depths, the velocities of discharge will be as the square roots of the depths. That is, if D is one foot below the surface, and A four feet, a *quart* will run from A, while only a *pint* will be discharged from an orifice of the same size at D.

16. *Frank*. As water will run into a submerged empty vessel with the same velocity that it will flow from a full one, I can see why a leak in a ship near the keel is so dangerous.

Mr. M. We have been talking about water in motion; let us now talk about hydraulic machinery. First, can each of you describe some method you have seen, or heard of, for raising water from wells?



Fig. 17, a Hindoo Picotah.

where the stream that comes down from the glen enters our "River."



Fig. 18, the excursion party at the well.

17. *Ida*. I have read, in an old book, of a curious method of raising water in Hindostan. It is called by the Hindoos a *picotah*. Here is a picture of it, which I think sufficiently describes itself, except that another person must stand by the well to empty the bucket.

Ella. We often see in the country a contrivance something like this, called a sweep, or a *well-sweep*.

Ida. Yes; and there is one yonder, just at the foot of the hill,

John. And many a draught of the purest water I have taken from the "old oaken bucket" that hangs there.

18. *Frank*. That old-fashioned sweep always reminds me of the first home that I knew, before I went to the city to reside, and of Woodworth's beautiful little poem, "The Bucket." How many times I have repeated that poem to myself when thinking of my early home.

Mr. M. Perhaps Master Frank will entertain us with a recitation of the piece, while Master George helps us to a practical illustration from the "moss-covered bucket" itself.

THE BUCKET.

19.

How dear to this heart are the scenes of my childhood,
When fond recollection presents them to view!
The orchard, the meadow, the deep-tangled wild wood,
And every loved spot which my infancy knew;
The wide-spreading pond, and the mill which stood by it,
The bridge, and the rock where the cataract fell;
The cot of my father, the dairy-house nigh it,
And e'en the rude bucket which hung in the well!
The old oaken bucket, the iron-bound bucket,
The moss-covered bucket, which hung in the well.

20.

That moss-covered vessel I hail as a treasure;
For often, at noon, when returned from the field,
I found it the source of an exquisite pleasure,
The purest and sweetest that nature can yield.
How ardent I seized it, with hands that were glowing,
And quick to the white-pebbled bottom it fell;

Then soon, with the emblem of truth overflowing,
And dripping with coolness, it rose from the well ;
The old oaken bucket, the iron-bound bucket,
The moss-covered bucket arose from the well.

21. How sweet from the green mossy brim to receive it,
As poised on the curb it inclined to my lips !
Not a full blushing goblet could tempt me to leave it,
Though filled with the nectar that Jupiter sips.
And now, far removed from the loved situation,
The tear of regret will intrusively swell,
As fancy reverts to my father's plantation,
And sighs for the bucket which hangs in the well ;
The old oaken bucket, the iron-bound bucket,
The moss-covered bucket, which hangs in the well.

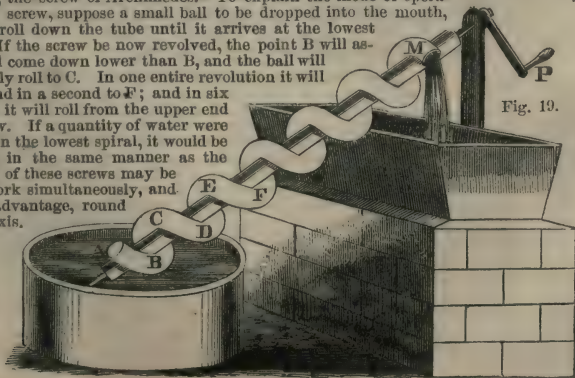
Mr. M. Both the poem and the illustration are excellent. All of you have doubtless seen both the common windlass and the chain-pump used for drawing water from wells and cisterns. But do you recollect, George, of a very ancient and singular invention for elevating water called the Screw of Archimēdes ?

George. Very well indeed. It is said to have been used by the Egyptians in draining their land from the overflowings of the Nile. It consists of a hollow screw-thread wound round an axis, and is turned by hand or by machinery. The water continually rises through the spire, and is discharged from the top.*

22. *Mr. M.* These are but a few of the methods which the ingenuity of man has devised for elevating water. I am glad you omitted all the usual kinds of pumps, as they belong to a future lesson. Can you give me, Frank, a description of any kind of water-wheel for propelling machinery ?

Frank. I have seen a mill driven by a large wheel called

* Fig. 19, the screw of Archimēdes. To explain the mode of operation of this screw, suppose a small ball to be dropped into the mouth, A ; it will roll down the tube until it arrives at the lowest point, B. If the screw be now revolved, the point B will ascend, C will come down lower than B, and the ball will consequently roll to C. In one entire revolution it will roll to D, and in a second to F ; and in six revolutions it will roll from the upper end of the screw. If a quantity of water were contained in the lowest spiral, it would be carried up in the same manner as the ball. Two of these screws may be made to work simultaneously, and to better advantage, round the same axis.



an undershot wheel, placed in the current. The force of the current turns the wheel, which moves the machinery connected with it.

23. *John.* There is an old wheel of this kind at the foot of the cascade which we are just coming to, and that will give us a practical illustration.

George. Where the streams are small, rapid, and have sufficient fall, I have frequently seen mills driven by what is called an overshot wheel. The water falls upon the wheel, and by its weight, principally, turns it.

Frank. There is also a water-wheel, called the *breast-wheel*, which receives the water against the side of it instead of the top or the bottom. In this case the water acts partly by its momentum and partly by its weight.

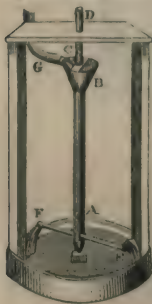
24. *Mr. M.* Of these wheels the overshot is the most powerful; but both that and the breast-wheel require a considerable fall of water, while the undershot wheel, which is the least powerful, requires merely a strong current.

Ida. I have seen the experiments with what is called "Barker's mill," which is moved by the pressure of a column of water.*

25. *Ella.* Here is the cascade itself; and there, at the foot of it, is the old wheel which John spoke of! I understand now what an *undershot* wheel is.

Ida. And don't you see—where the water tumbles over that ledge—another little wheel? That is a *breast-wheel*. How swiftly it spins round!

Ella. And there is still another and larger wheel lower down! That is an *overshot* wheel. It does seem as though some one has had all these wheels put up for the purpose of illustrating this lesson in hydraulics!



* Fig. 20, Barker's mill. In what is called "Barker's mill," the machinery is moved by hydrostatic pressure. It consists of a hollow cylindrical pipe, A B, of considerable height, terminating above in a funnel-shaped cavity, resting below on a pointed steel pivot, and communicating below with a cross tube, or arms, E F, closed at the extremities, but having openings on the opposite sides, near each end of the cross tube. A pipe, G, above, regulates the supply of water, and keeps the vertical pipe full.

If the openings at E and F be closed, it is evident that the hydrostatic pressure in the cross tube will be the same on all parts of its surface, and will be proportioned to the height of the pipe A B; but let the water flow at the orifices, and there will be more pressure on one side of the cross tube than on the other, and the machine will revolve in the direction of the greater pressure.

The movement of Barker's mill was long attributed, but erroneously, to the *reaction* of the jets (pressing upon the elastic air) against the extremities of the cross tubes. On the principle of hydrostatic pressure, as here illustrated, the *turbine* wheel has lately been invented. It is the most powerful and economical of all water-engines. See Fig. 21, next page.

26. All seemed to be of the same opinion ; while Mr. Maynard only smiled, and said he hoped they would examine all the wheels, and be able to give a full description of them at another time. All were soon busy in clambering up the rocks, and noticing the working of the wheels ; and after some time spent in this way, all returned to the foot of the cascade, when John described the new *turbine* wheel which his father had lately had put up in his mill, and which is moved by the action of the pressure of a column of water.*

"This wheel," said Mr. Maynard, "can be made to *utilize* from three fourths to four fifths of the theoretical power of the water, while the undershot wheel will not often give to machinery more than one quarter of the water power. The breast-wheel, when well constructed, will utilize a little more than one half of the moving power of the water, and the overshot wheel about two thirds."

Before the little party left this pleasant spot, Frank happened to remark that the numerous little water-falls in this cascade forcibly reminded him of Southey's poem about the "Cataract of Lodore," "for the water," said he, "comes running, and jumping, and dancing, and leaping down in almost every imaginable variety of form and motion." Thereupon Frank, being invited to recite the poem, gave the following :

THE CASCADES OF ROCKY GLEN.

[The Cataract of Lodore.]

"How does the water come down at Lodore?"

My little boy asked me thus, once on a time ;

And moreover he tasked me

To tell him in rhyme.

Anon at the word,

There first came one daughter,

And then came another,



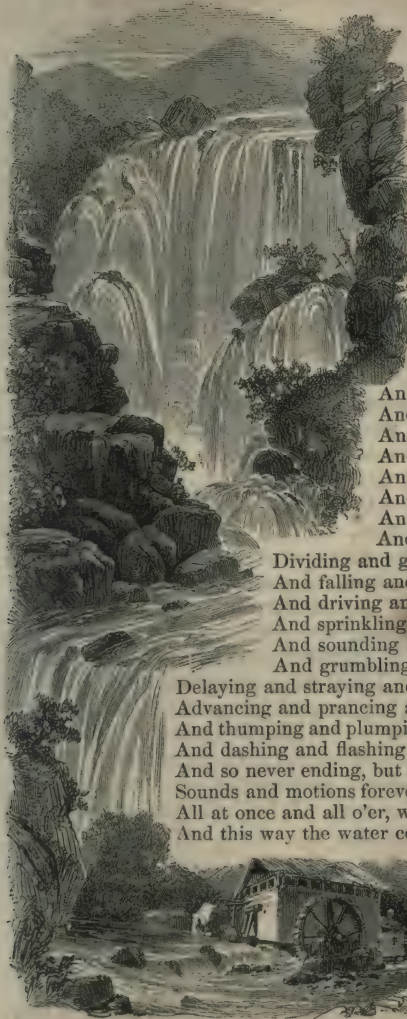
* Fig. 21, the *turbine* wheel, consists of a fixed upright cylinder I J, which admits the water, placed upon another and larger fixed cylinder, represented here by the inner curves, the latter encompassed by the moving wheel A B, in the form of a rim. Through N passes a shaft, by which motion is imparted to machinery. From the tall central cylinder the water passes, under great pressure, into the curved compartments of the larger fixed cylinder, where it receives such a direction as to strike the divisions of the revolving rim to the best advantage. As this wheel acts upon the principle of hydrostatic pressure, its power is proportionate to the height of the column of water in the central cylinder I J. When a column of water can be obtained of considerable height, the turbine wheel is an engine of great power. It is extensively used in the cotton factories of Lowell, Mass.

To second and third the request of their brother,
 And to hear how the water comes down at Lodore,
 With its rush and its roar,
 As many a time
 They had seen it before.
 So I told them in rhyme,
 For of rhymes I had store.



From its sources, which well
 In the tarn on the fell ;
 From its fountains
 In the mountains ;
 Its rills and its gills ;
 Through moss and through brake,
 It runs and it creeps
 For a while, till it sleeps
 In its own little lake.
 And thence, at departing,
 Awakening and starting,
 It runs through the reeds,
 And away it proceeds,
 Through meadow and glade,
 In sun and in shade,
 And through the wood-shelter,
 Among crags in its flurry,
 Helter-skelter,
 Hurry-scurry.
 Here it comes sparkling,
 And there it lies darkling :
 Now smoking and frothing,
 In tumult and wrath in,
 Till, in this rapid race
 On which it is bent,
 It reaches the place
 Of its steep descent.

The cataract strong
 Then plunges along,
 Striking and raging,
 As if a war waging
 Its caverns and rocks among ;
 Rising and leaping,
 Sinking and creeping,
 Swelling and sweeping,
 Showering and springing,
 Flying and flinging,
 Writhing and ringing,
 Eddying and whisking,
 Turning and twisting,
 Spouting and frisking
 Around and around,
 With endless rebound ;
 Smiting and fighting,
 A sight to delight in ;
 Confounding, astounding,



Dizzying and deafening the
ear with its sound :

Collecting, projecting,
Receding and speeding,
And shocking and rocking,
And darting and parting,
And threading and spreading,
And whizzing and hissing,
And dripping and skipping,
And hitting and splitting,
And shining and twining,
And rattling and battling,
And shaking and quaking,
And pouring and roaring,
And waving and raving,
And tossing and crossing,
And foaming and roaming,
And dinning and spinning,
And guggling and struggling,

And heaving and cleaving,
And moaning and groaning ;
And glittering and frittering,
And gathering and feathering,
And whitening and brightening,
And quivering and shivering,
And hurrying and skurrying,
And thundering and floundering ;

Dividing and gliding and sliding,
And falling and brawling and sprawling,
And driving and riving and striving,
And sprinkling and twinkling and wrinkling,
And sounding and bounding and rounding,
And grumbling and rumbling and tumbling,

Delaying and straying and playing and spraying,
Advancing and prancing and glancing and dancing,
And thumping and plumping and bumping and jumping,
And dashing and flashing and splashing and clashing ;
And so never ending, but always descending,
Sounds and motions forever are blending,
All at once and all o'er, with a mighty uproar—
And this way the water comes down at Lodore.

After the recital of this very eccentric poem, as Ida called it, and some remarks from Mr. Maynard upon its character, and the proper reading of it, the little party set out on their

return homeward, both pleased and profited by their day's excursion.

¹ Coot, a lobe-footed water-fowl.

² HERN, contracted from *heron*.

³ BICK'-ER, to move unsteadily; to play backward and forward.

⁴ THORP, a small village; a hamlet.

LESSON VI.—PNEUMATICS.

1. "My young friends," said Mr. Maynard, as he approached a large table covered with numerous tubes, glasses, pumps, jars, etc., "if you have carefully read the books you possess, and such as I loaned you from the library, you can make this one of the most delightful lessons in our whole course. *Pneumatics*, you know, is the science of the pressure and motion of elastic fluids. Air and steam are good examples of elastic fluids; the former representing such as are permanently gaseous, and the latter such as are condensible into a liquid state. Do you recollect what we gave in a former lesson as one of the characteristics of elastic fluids?"

2. *Frank*. I think it was their immediate tendency to expand when at liberty to do so.

Mr. M. You will see by some experiments with the *air-pump* that air is highly elastic. I would first state that we are living in an ocean of atmosphere about fifty miles in height, and quite surrounding the globe. The air-pump is similar to a water-pump in construction, but made so accurately as not to leak air. I will now pump some of the air



Fig. 22, atmospheric pressure.

from this glass, which you see is open at both ends; but, in order to remove the air, or rather to obtain a vacuum inside, it will be necessary to stop the air from entering from the top. John, will you place your hand on the top for a stopper? I will now remove the air from under John's hand.

3. "Oh!" exclaimed John, "it sucks my hand down."

"What sucks your hand down?" said Mr. M.

"Really," replied John, "I think I was mistaken, for I now understand that it is the *weight* of the air on my hand *pressing* it down. I learned long ago that the weight of the atmosphere is about fifteen pounds on a square inch, but I never before had so clear an idea of it."

4. *Mr. M*. Why could you not move your hand from the

glass as well after the exhaustion as before? Was there any more pressure put upon your hand by the operation?

John. The weight was certainly no more, but the sustaining spring or elasticity of the air was removed from below, and I felt the pressure, just as a man feels the pressure of debts when he has no money with which to pay them.

5. *Mr. M.* To understand all about the weight and elasticity of air is to understand *pneumatics*. Have any of you ascertained the entire weight of the atmosphere, which seems so light?

Ella. Somebody has calculated that the weight of the atmosphere is equal to that of a solid sphere of lead sixty miles in diameter. I would much like to understand how such astonishing calculations are made.

6. *Ida.* It is very easy indeed. We know that the pressure of air is fifteen pounds on each square inch; and all we have to do is to find how many square inches there are on the earth's surface, and multiply by fifteen to obtain an answer in pounds.

Ella. How do people know that the pressure is fifteen pounds on a square inch?

Ida. It is in all the Philosophies.

7. *Ella.* But how did the *philosophers* find it out? I would also like to know *how* it is known to be about fifty miles high.

Mr. M. I perceive that Frank has been examining that matter, and that while you have been talking he has been figuring. I presume he can read to us, from the book which he has in his hand, an account of the way in which this great discovery was first made.

8. *Frank.* "The common pump was invented by Ctesibius 224 years B.C., and soon after it came into general use throughout the civilized world. The philosophers of the time explained its action by saying that when the piston was raised in pumping, and the air thereby removed, a vacuum would be formed over the water, but that 'nature abhorred a vacuum,' and consequently filled it with water as the most convenient material.

9. "So the water kept rising at each stroke of the pump, as the air was removed. Some wells were very deep, and it was found that whenever the depth was over 33 feet, the pumps were unable to raise the water. Finally, some engineers asked Galileo why the water would not rise higher than 33 feet. He is said to have replied that 'nature's abhorrence of a vacuum ceased at the height of 33 feet.'"

10. *Mr. M.* Though the great Galileo did not know the true theory of the common pump, he certainly must have given such an answer rather in joke than in earnest. But let us have the rest of Frank's account.

11. *Frank.* "It is supposed that Galileo suggested to his pupil Torricelli that the weight of the air on the water surrounding the pump might press the water up into the pump when the pressure within the pump was removed. Galileo died soon after, and the next year, 1643, Torricelli determined to find out all about it. He thought that if the weight of the air was the cause, he could try the experiment of sustaining, by the pressure of the atmosphere, a column of water 33 feet high in a tube closed at the upper end. This would have been a difficult experiment to perform; but, fortunately, he knew that the specific gravity of quicksilver was $13\frac{1}{2}$ times that of water. Of course a column of quicksilver $2\frac{1}{2}$ feet high would bal-

ance a column of water $13\frac{1}{2}$ times as high, or about 33 feet.

12. "Torricelli took a glass tube more than $2\frac{1}{2}$ feet long, and filled it with quicksilver, and, after closing the upper end, inverted it, placing the end below the surface of quicksilver in a cup before removing his thumb. As he expected, the quicksilver did not all run down into the cup, but stood at the height of 30 inches in the tube. Evidently the pressure of the atmosphere upon the quicksilver in the cup sustained the column in the tube; and as the tube was one inch in area, and the column of quicksilver weighed 15 pounds, not only was the pressure of the atmosphere on a square inch of surface ascertained, but the instrument called the *barometer* was invented—an instrument to show the pressure of the atmosphere at different times and in different places."

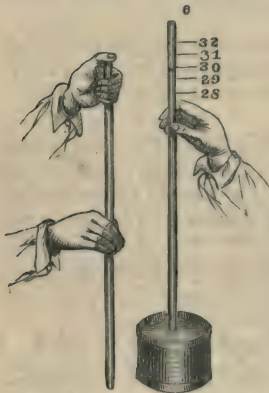


Fig. 23, Torricelli's experiment.

13. *Ella.* It would be very easy to try the experiment of Torricelli.

Mr. M. Will George tell me, now, how the *altitude* of the atmosphere is found by this instrument, the barometer?

George. By carrying a barometer up a high mountain, and noticing how much the mercury falls—that is, how much the pressure diminishes for every hundred or five hundred feet we ascend, we can easily calculate at what height there will be no pressure, and consequently no atmosphere, which is at a height of about forty-five miles.

14. *Mr. M.* That is correct. The pressure diminishes in a geometrical ratio as we ascend. Thus, at about four miles above the earth the air is only half as dense as at the surface; at eight miles, one fourth; and at twelve miles, one eighth, etc. But of what practical use is the barometer?

Ida. After once knowing how the barometer stands at different heights from the sea, it enables us to measure the height of mountains.

Frank. And also to foretell storms; for, as the air is usually lighter before a storm, this lightness is indicated by the falling of the quicksilver. I was reading this morning, in "Darwin's Botanic Garden,"

"How up exhausted tubes bright currents flow
Of liquid amber from the lake below,
Weigh the long column of the incumbent skies,
And with the changeful moment fall and rise."

15. *Mr. M.* Dr. Arnott relates a striking instance, which occurred to himself, of the great practical value of the barometer. I will read his account:

"We were in a southern latitude. The sun had just set with placid appearance after a beautiful day, and the usual mirth of the evening watch was proceeding, when the captain's order came to prepare with all haste for a storm. The barometer had begun to fall with appalling rapidity. As yet, the old sailors had not perceived even a threatening in the sky, and they were surprised at the extent and hurry of the preparations; but the required measures were not complete, when a more awful hurricane burst upon them than the most experienced had ever braved. Nothing could withstand it: the sails, already furled and closely bound to the yards, were riven away in tatters; even the bare yards and masts were in great part disabled, and at one time the whole rigging had nearly fallen by the board.

16. "Such, for a few hours, was the mingled roar of the hurricane above, of the waves around, and of the incessant peals of thunder, that no human voice could be heard, and, amid the general consternation, even the trumpet sounded in vain. In that awful night, but for the little tube of mercury which had given the warning, neither the extraordinary strength of the noble ship, nor the skill and energies of the commander would have saved one man to tell the tale. On the following morning the wind was again at rest, but the ship lay upon the yet heaving waves an unsightly wreck."

17. *Ella.* As the density of air diminishes so rapidly in ascending, would it not increase in the same ratio in descending below the surface of the earth?

Mr. M. Certainly; and at a depth of 58 miles the air we breathe would be more dense than gold, or the heaviest known substance, unless at that depth the pressure of the air should be partially modified by the attraction of the earth above. We should not think the saying, "*light as air*" very appropriate under such a pressure. Who can tell me on what principle smoke is "*drawn into the mouth*," as it is said, in the process of smoking a cigar?

18. *John.* On the principle that a vacuum is produced in the mouth by the action of the cheeks, and the smoke is forced through the cigar by atmospheric pressure.

Ella. If that is so, a cigar in the smoking process must have *fire* at one end and a *vacuum* at the other.

Mr. M. Though your remark is very hard upon smokers,

it is the true philosophical explanation. Particles of snuff are carried up into the nose, in opposition to gravity, by the pressure of the air.

19. *Ella*. As the air at different heights is of different degrees of density, does it not make a difference in the weight of bodies?

Mr. M. Certainly it does; it makes a very great difference. The more dense the fluid in which the body is weighed, the less it weighs—as you have already seen that a body weighs less in water than in the air (see p. 329).

George. I would like to ask Miss Ida which is the heaviest—a pound of feathers' or a pound of lead'?

Ida. They are both of the same weight, to be sure!

20. *Mr. M.* Do not be too certain of that; for I think, after a little reflection, you will change your opinion. A pound of feathers, cork, or any other bulky substance which just balances a dense body, as lead or gold, in the air, is really heavier than the lead or gold. If a lump of iron will balance a stone when both are suspended in a tub of water, they will not balance when the water is withdrawn; but the stone, which is the more bulky substance, will be found to weigh the most. So, also, if a bag of feathers balance a pound of lead in the air, if the scales are then placed in the exhausted receiver of an air-pump, the feathers will be found to weigh the most.

21. *Ida*. I understand the principle now. I perceive, also, that if the bag of feathers were *lighter* than the atmosphere, it would not weigh any thing at all in the open air, while it *would* weigh something in a vacuum.

Mr. M. The feathers, in this case, would rise as smoke does, until they became of the same specific gravity as the surrounding air. This is the principle on which the balloon rises, as it is filled with hydrogen gas, which is only one sixteenth of the weight of the atmosphere. Although hydrogen gas weighs nothing in the atmosphere near the earth, yet it *has* weight.

Ella. How high have persons ascended in balloons?

22. *Mr. M.* Gay-Lussac reached a height of more than four miles and a quarter, and brought down samples of air, which he analyzed, and found to consist of the same proportions of oxygen and hydrogen gases as air near the surface of the earth.

Frank. I have read that Napoleon III. sent up men in a balloon to reconnoiter the position of the Austrians before the battle of Solferino.

John. It must be a very rapid way of traveling "on the wings of the wind;" for on the first of July, 1859, Mr. Wise and three other persons ascended from St. Louis, Mo., and nineteen hours later landed in Jefferson county, N. Y., having passed over a distance of 1150 miles. This was traveling about a mile in a minute.

23. *Ella.* I noticed in some of the experiments that the outside of the glass receiver became covered with mist when the air was exhausted. I suppose there must be a cause for it, but I can not imagine why it should happen.

Mr. M. By rarefaction a greater degree of cold is produced in the receiver, and the vapor of the surrounding air is condensed thereby. The writer of the "Botanic Garden" has thus described it:

"Now in brazen pumps the pistons move,
The membrane valve sustains the weight above;
Stroke follows stroke, the gelid vapor falls,
And misty dewdrops dim the crystal walls;
Rare and more rare expands the fluid thin,
And silence dwells with vacancy within."

You will understand the last reference to "silence" when you study the subject of Acoustics, or *Sound*.

24. *Ida.* As high mountains, even in the torrid zone, are covered with snow, is not the air much the coldest in the upper regions of the atmosphere?

Mr. M. It has been found that it is two degrees colder at the dome of St. Peter's Church than on the ground; and if we were to continue to ascend, the temperature would diminish about one degree for every hundred yards. In latitude 36°, the mean height at which water congeals is only two miles.

25. *John.* Then, if we send a bucket of *water* up two miles in a balloon, it will come down *ice*.

Frank. Is it possible that water will always freeze, even in the bright sunshine, within two or three miles of us?

Mr. M. It is possible and probable; for the same reason that a thermometer will show a diminution of heat in an exhausted receiver, it will indicate cold as it is carried up to an atmosphere less dense.

26. *Ella.* I should think that *cold* would make the air more dense, and that *heat* would expand it.

Mr. M. That is the case with most substances; but air has a greater tendency to expand from diminished pressure than to be contracted by the cold consequent on such expansion.

27. *George.* It must be very difficult for the inhabitants of

such cities as Quito, and others situated on high mountains, to cook their food by boiling, as water boils at a lower temperature as the pressure of air on its surface is diminished. I have read that on Mt. Blanc, Saussure found the temperature of boiling water to be 180° , while it was 212° at the sea level.

Ella. He could not boil potatoes soft in water of that temperature. But why could he not make the water hotter by more fire?

28. *Mr. M.* More fire can not raise water to a greater temperature than 212° at the ocean level, nor more than 180° on the summit of Mt. Blanc, unless it is confined as in a steam boiler.

Frank. That is the way they measure the altitude of mountains by boiling water. For every 520 feet in height, the boiling point is lowered one degree.

Ella. I have just calculated the height of Mt. Blanc to be 16,640 feet, or 32 times 520. But how did Saussure

"Breathe the difficult air
Of the ice'd mountain top?"

29. *Mr. M.* He breathed, indeed, with difficulty; but the change was so gradual that he experienced no permanent injury. Persons in going up in balloons have ruptured blood-vessels, and have had the blood start from their "very fingers' ends" by the withdrawal of a portion of the atmospheric pressure to which they had been accustomed. Yet it has been noticed that the inhabitants of Quito, Mexico, and other elevated places do not suffer in this way, because they gradually become accustomed to the rarity of the atmosphere; and, moreover, they have larger chests than those living in lowlands, because a larger bulk of air is necessary to furnish the requisite amount of oxygen to sustain life.

30. *George.* It appears, then, that as we rise from the ocean level, the air becomes so *rare* that we breathe it with difficulty; and if we should descend a few miles into the earth, it would become so *dense* that we could not breathe it.

Mr. M. This shows the law of *adaptation*; that the Creator has adapted our bodies to that particular sphere of existence in which he designed us to move. Yet this is but one example, out of thousands, of a law which pervades all animated nature.

LESSON VII.—ATMOSPHERIC MACHINES.

1. *Mr. M.* BOTH the balloon and the wind-mill are atmospheric machines; but I desire now to call your attention to others of a somewhat different character. You have seen that even the process of *smoking a cigar* is on the principle of atmospheric pressure. Can you think of any other illustration of this principle?

Ida. I have seen boys with straws for tubes, and their cheeks for air-pumps, allowing the atmosphere to force sweet cider into their mouths.

2. *Ella.* I believe that somewhere in South America the ladies take tea in that manner.

John. The negroes in some of the West Indies are said to steal rum from full casks by filling a bottle with water, and inverting it in the bung-hole of the cask, somewhat as Torricelli made his barometer. In this case, however, the water, being more dense than the rum, descends, while the rum rises into the bottle.

3. *George.* Liquids are often transferred from one cask to another by means of a bent tube.



Fig. 24, the Siphon.

Mr. M. This is the siphon. It is first filled, and one end is immersed in the liquid to be discharged. It is always necessary that the end *from* which the liquid runs should be lower than the surface of the liquid in the vessel. Can either of you explain the action of the siphon?

4. *John.* The liquid in the long column will run out by the force of gravity, and a vacuum would be formed in the tube, did not the pressure of the atmosphere constantly force up a corresponding quantity out of the cup to supply its place.



Fig. 25, Tantalus's Cup.

Ida. There must be a siphon in that piece of apparatus called Tantalus's cup, which will never get full, although a small stream of water is poured in for hours. The water runs out through the siphon as fast as it is poured in. Would not this be a good way to discharge the water from a leaking ship?

5. *Mr. M.* The only trouble would be that, if the siphon acted at all, the water would run *into* the ship instead of *out* of it.

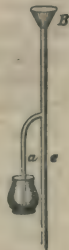


Fig. 26, Siphon Fountain.

is filled with water. I now pour a pitcher of water into the funnel B. You see the jar is emptied; for the water, running up through *a* and down the pipe *c*, is discharged with the water poured in at the top. Who can explain it?

7. *John*. I suppose the column of water in *c* contracts in its descent in the tube, just as a stream of molasses does in air, and consequently does not entirely fill the tube. The water, too, by its friction, tends to draw in the air of the tube *a*, and the external air forces the water of the jar up into the partial vacuum so formed. It is very curious, but is it of any practical use?

Fig. 27.



8. *Mr. M*. It has been made of great use, for marshes have been drained on this principle; and in the circulating system of animals there are arrangements of blood-vessels by which a current of blood passing along one vein may assist in emptying a lateral branch. It is by no means necessary for the stream of water to descend vertically, as it may run at any angle, or even horizontally.

Ida. Does Hiero's fountain depend upon atmospheric pressure?

Mr. M. It depends on the pressure of a column of water and the elasticity of air. The one I have here is mainly constructed of glass, to enable you to see its mode of action. You can examine its principle at your leisure.*



Fig. 28, Hiero's Fountain.

* "Hiero's fountain" explained. Water is poured into the glass vessel B until it is nearly full, while the glass vessel C contains only air. Into the vessel A is now poured a little water, which flows through the pipe F, and displaces some of the air in C by

George. Will not the explanation of the *common pump* belong to this lesson?

9. *Mr. M.* Its principle has already been illustrated in the account which was given of the discovery of the weight of the atmosphere. It is evident that we have only to exhaust the air in a pipe, the open end of which is placed in water, and the water will be pressed up to fill the vacuum. Here are illustrations of two different kinds of pumps, one of which is the forcing-pump, which illustrates the principle of the fire-engine.*

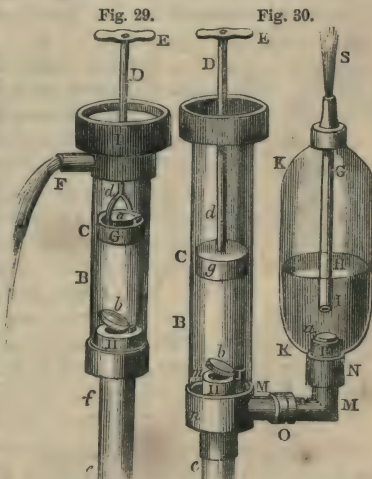
Frank. Darwin very prettily explains the action of the common pump in the following lines :

" Thus does the sliding piston bear
The viewless columns of incumbent air;
Press'd by the incumbent air, the floods below,
Through opening valves, in foaming torrents flow,
Foot after foot with lessened impulse move,
And, rising, seek the vacancy above."

forcing it up through D. There is now a pressure of air on the water in B equivalent to the pressure exerted (on the principle of the hydrostatic paradox) by the column of water in F, and this pressure is exerted to throw the water up through E and cause the play of the fountain. Thus the contents of B are actually transferred to C, and the air that was in C passes into B. When C thus becomes filled with water and B with air, the fountain must stop.

* The common pump, represented by Fig. 29, consists of three parts, the suction-pipe, the barrel, and the piston. The suction-pipe, *f e*, is of sufficient length to reach down to the water in the well. The barrel, C B, is a perfect cylindrical cavity, in which the piston G moves, air-tight, up and down by the rod *d*. It is commonly moved by a lever, but in the figure a rod and handle, D E, are represented. On one side is the spout F. At the top of the suction-pipe at H there is a valve, *b*, opening upward, and also one at *a*. When the piston is raised from the bottom of the barrel, a vacuum is produced in the barrel, the valve *b* opens, and if the pipe, *f e*, be full of water, the water rushes into the barrel, being pressed up by the atmosphere resting on the water in the well. On depressing the piston the water rushes up through the valve *a*, and after a few movements the water is poured out at the spout F.

In the forcing-pump, Fig. 30, the piston, *g*, has no valve. On the box at H is a valve, *b*, opening upward, and when the piston is elevated the water rises into the barrel, B C. During the downward movement of the piston the valve *b* shuts, and the water passes by a channel around *m*, through the lateral pipe M O M N into the air-chamber, K K. The entrance to this air-chamber is closed by a valve at *a*, and from the chamber proceeds a tube, H G, open at both ends. After a few movements of the piston the lower end of this tube becomes covered with water, the air is compressed into the space G H, and thereby the water is thrown out in a continuous jet, S.



10. *Mr. M.* Do you know of any instrument besides the forcing-pump and the fire-engine that acts upon the principle of condensed air?

John. I have seen an air-gun charged with air instead of powder.

Mr. M. That is a good illustration of the principle that *the density and elasticity of air are directly as the force of compression.* Here is a drawing of the air-gun. Air is condensed into the

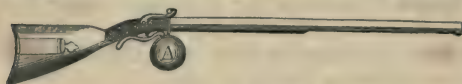


Fig. 31, the Air-gun.

ball A, which is attached to the gun. A bullet is then put into the

barrel, and by a peculiar lock a portion of the condensed air is let in behind the bullet, which is thrown out with almost the force of gunpowder.

George. Can another bullet be thrown out without refilling the ball?

11. *Mr. M.* Yes, a dozen or more; but each one with less force than the one before it, as the air in the ball gradually loses its density, and consequently its elasticity. Sometimes the air-chamber is in the stock of the gun, which makes it more convenient.



Fig. 32, Bottle Fountain.

John. I have made little fountains by inserting through the cork of a bottle half filled with water a common pipe-stem, and after blowing through the tube the water would spout up to a considerable height. Was not this owing to condensed air pressing on the surface of the water?

Mr. M. It was caused by condensed air; but you had to be careful to let the tube reach below the surface of the water?

Ella. Is not the kite an atmospheric machine?

12. *Mr. M.* Yes; and although it is a *playing* machine, it is elevated on strictly scientific principles. It is really pulled up an inclined plane of air by the tension and weight of the string.*



* Fig. 33. The kite here appears in the act of rising from the ground. As the wind, coming from the direction of W, falls upon the oblique surface of the kite, it is resolved into two forces, one parallel to that surface (B O), and the other perpendicular to it (Y O), of which the latter only will produce any effect, carrying the kite along the line O A. But the kite is

also pulled in the direction S T. It is therefore under the influence of the two forces O A

Ida. And so the kite *slid down the plane* when the boy clapped his hands and let the string slip through his silly fingers!

Frank. This reminds me of a very pretty piece of poetry about "the lost kite."

Mr. M. I am glad to find you so imbued with the poetry of science; and as this lesson has not been very poetical, you may repeat the piece, if you please.

THE LOST KITE.

13. My kite! my kite! I've lost my kite!
Oh! when I saw the steady flight
With which she gained her lofty height,
How could I know that letting go
That naughty string would bring so low
My pretty, buoyant, darling kite,
To pass forever out of sight?
14. A purple cloud was sailing by,
With silver fringes o'er the sky;
And then I thought, it seemed so nigh,
I'd make my kite go up and light
Upon its edge so soft and bright,
To see how noble, high, and proud
She'd look while riding on a cloud!
15. As near her shining mark she drew,
I clapped my hands; the line slipped through
My silly fingers; and she flew
Away! away! in airy play,
Right over where the water lay!
She veered and fluttered, swung, and gave
A plunge, then vanished in the wave!
16. I never more shall want to look
On that false cloud or babbling brook;
Nor e'er to feel the breeze that took
My dearest joy, to thus destroy
The pastime of your happy boy.
My kite! my kite! how sad to think
She flew so high, so soon to sink!
17. "Be this," the mother said, and smiled,
"A lesson to thee, simple child!
And when, by fancies vain and wild
As that which cost the kite that's lost,
Thy busy brain again is crossed,
Of shining vapor then beware,
Nor trust thy joys to fickle air!"
18. "I have a darling treasure, too,
That sometimes would, by slipping through
My guardian hands, the way pursue
From which, more tight than thou thy kite,
I hold my jewel, new and bright,
Lest he should stray without a guide,
To drown my hopes in sorrow's tide!"

19. *Mr. M.* There are many natural phenomena dependent on the atmosphere which we shall learn in the department of Physical Geography. But, before we conclude this lesson on

and ST; and since these are in the direction of the two sides of a parallelogram, it will not obey either, but ascend through O B, its diagonal. (See Fourth Reader, p. 298.) It is thus virtually pulled up the inclined plane O B.

pneumatics, I desire to read you a riddle, hoping each of you will be *Œdipus* enough to guess the answer.

A RIDDLE.

20.

"Mortal', wouldst thou know my name',
 Scan the powers I proudly claim'.
 O'er this globe's capacious round
 With fairy sprightliness I bound';
 O'er sea and land my power extends,
 To every herb my care descends.
 Did I withhold my vital breath',
 Nature's forms would sink in death'.
 When confined, or swiftly driven
 By angry spirits in the heaven',
 My wrath in thunders I make known',
 And Discord claims me as her own'.
 'Tis love of freedom makes me wild—
 When uncontroll'd, my nature's mild;
 And oft the nymph', in dewy grot',
 Seeks solace from my plaintive note';
 O'er lovers' graves I waft a sigh,
 And breathe the sound of sympathy.

21.

And know, ye sons of Albion's isle',
 That when the Hero of the Nile,
 Midst crowds with mournful pomp array'd,
 In the cold lap of Earth was laid',
 I sympathized with Britain's tear,
 And waved the banner o'er his bier'.
 'Tis I who from the trembling lyre
 Breathe tones of love and soft desire';
 'Tis I, the spirit of the shell,
 Who fill with notes the listening dell';
 And, when the war-trump sounds alarm',
 'Tis I who summon men to arm'.
 Made captive by the arts of man',
 My various services began';
 To grind his corn', to drain his lands',
 I soon was tasked', to spare his hands'.
 Should he to foreign climes proceed',
 He yokes me like the neighing steed',
 And, by my quick but easy motion',
 He traverses the stormy ocean'.

22.

His children, too, my presence court',
 To give them toys', and make them sport':
 Without my aid, their kites would lie
 As useless weights, that ne'er could fly';
 Their humming-tops would soundless spin,
 Unless I breathed a spell within':
 The modest maid, without my power,
 Would wither like her kindred flower'.
 Unless my cup of sweets she sips',
 Where are the rubies of her lips'?
 Unless my glowing rouge she seeks',
 Where are the roses of her cheeks'?
 What art again can strew her tresses
 With half the grace my skill possesses'?
 Ev'n goddesses are represented
 In draperies which I invented.
 Sometimes', 'tis true', I am so frail
 As ruffian-like to raise your veil',
 And thus to curious man reveal
 The charms you modestly conceal'.
 Revenge the deed'. Announce my Name',
 For now you know the powers I claim'."

23. "It must be *air*," exclaimed the whole class with one

voice. "But what is meant by the allusion to the funeral of the 'hero of the Nile?'" said Ida.

Mr. M. I quote an extract from the description of the ceremonies of Nelson's interment in St. Paul's: "Never shall I forget the thrilling effect which was produced on the assembled multitude by the solemn movement of the banners in the dome as the bier slowly advanced along the aisle in the Cathedral; a movement which was accidentally occasioned by a current of *air* from the western entrance, although, to the eye of fancy, it seemed as if some attendant spirit had directed the colors, under which the hero had bled and conquered, to offer this supernatural testimony of respect and sorrow."

LESSON VIII.—THE STEAM-ENGINE.

1. "You recollect," said Mr. Maynard, "that it was stated in a former lesson that water does not require to be so hot to boil when the pressure of the atmosphere is partially removed, as it does when it is subject to that pressure."

John. I recollect it, and I would ask if it does not require a higher temperature when the pressure is increased.

2. *Mr. M.* Under ordinary circumstances of the pressure of one atmosphere, of 15 pounds on the square inch, water boils at the temperature of 212° ; but increase the pressure to 45 pounds on each square inch, or three atmospheres, and it will not boil below 275° .

Frank. There is a kind of kettle, made very strong, with an air-tight cover which is fastened down, and as the steam which first rises presses down by its elasticity, the water becomes hot enough to cook bones.

3. *Mr. M.* That is called Papin's Digester, and in it the water really never boils, but it becomes sufficiently hot to cause the separation of the gelatinous matter from bones. As this is used for soup, I suppose you call it cooking bones.

Ella. I should not like to have one of those dangerous kettles in our kitchen, for fear it would burst.

Mr. M. It has an orifice closed with a plug, which is held down by a weight until a certain pressure is exerted by the steam, when it rises up and lets the steam escape. It then falls back again until the pressure becomes sufficient to raise it.

4. *Ida.* Is that what is called the safety valve?

Mr. M. It is; and safety valves are used in all boilers where the steam is liable to be very much compressed.

George. In preparing for this lesson, I learned that one cubic inch of water will form about a cubic foot of steam, which will be condensed into a cubic inch of water again when cooled below the boiling-point.

5. *Mr. M.* You have learned in that fact the great principle on which the steam-engine acts. The instrument represented in the figure gives a clear idea of the elementary parts of what is called the *low-pressure* steam-engine.* It consists of a cylindrical glass tube, B, terminating in a bulb, A. In the tube a piston moves up and down, air-tight, and a little water having been placed in the bulb, it is brought to the boiling-point by the application of a lamp. As the steam forms, it presses the piston upward by reason of its elastic force; but on dipping the bulb into cold water, the steam condenses, and

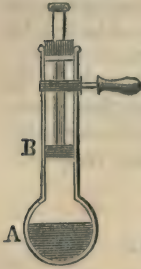
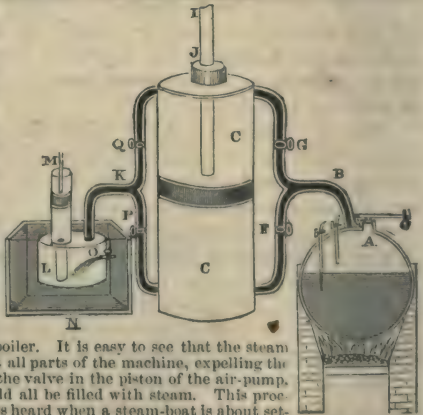


Fig. 34.

produces a partial vacuum, and the piston is then driven downward by the pressure of the external air.

6. *John.* And if the rod attached to the piston were made to turn a crank, or work a lever, it would very well illustrate the working of a steam-engine.

* Low-pressure Engine, Fig. 35. The chief parts of this engine are the boiler, A, the cylinder, C, the piston-rod, I J, the condenser, L, and the air-pump, M. B is the steam-pipe, branching into two arms, communicating respectively with the top and bottom of the cylinder, and K is the eduction-pipe, formed of the two branches which proceed from the top and bottom of the cylinder, and communicating with the cylinder and the condenser. N is a cistern, or well of cold water, in which the condenser is immersed. Each branch of pipe has its own valve, as F, G, P, Q, which may be opened or closed as the occasion requires. Suppose, first, that all the valves are open, while steam is issuing freely from the boiler. It is easy to see that the steam would circulate freely throughout all parts of the machine, expelling the air, which would escape through the valve in the piston of the air-pump, and thus the interior spaces would all be filled with steam. This process is called blowing through; it is heard when a steam-boat is about settling off. Next, the valves F and Q are closed, G and P remaining open. The steam now pressing the cylinder forces it down, and the instant when it begins to descend the stop-cock O is opened, admitting cold water, which meets the steam as it rushes from the cylinder, and effectually condenses it, leaving no force below the piston to oppose its descent. Lastly, G and P being closed, F and Q are opened, the steam flows in below the piston, and rushes from above it into the condenser, by which means the piston is forced up again with the same power as that with which it descended. Meanwhile the air-pump is playing, and removing the water and air from the condenser.



The steam now

Mr. M. Can George now tell in what respect the *high-pressure* steam-engine differs from the low-pressure?

George. In the high-pressure engine, the steam, being admitted first on one side of the piston and then on the other, is pushed out against the atmosphere; but in the low-pressure, a partial vacuum is produced alternately on each side of the piston by allowing the steam to escape into a fountain of cold water, which condenses it.

7. *Mr. M.* I have here a very interesting description of the steam-engine, and of its wonderful power and multiplied uses, by Dr. Arnott, and I will read the closing part of it to you. In the view here taken of it, you see the steam-engine is not only a wonderful instrument in itself, but one of the most effective instruments of human progress and civilization ever invented.

8. "It regulates with perfect accuracy and uniformity the number of its strokes in a given time, counting or recording them, moreover, to tell how much work it has done, as a clock records the beats of its pendulum; it regulates the quantity of steam admitted to work, the briskness of the fire, the supply of water to the boiler, the supply of coals to the fire; it opens and shuts its valves with absolute precision as to time and manner; it oils its joints; it takes out any air which may accidentally enter into parts which should be vacuum; and when any thing goes wrong which it can not of itself rectify, it warns its attendants by ringing a bell.

9. "Yet with all these talents and qualities, and even when exerting the power of six hundred horses, it is obedient to the hand of a child. Its aliment is coal, wood, charcoal, or other combustibles; it consumes none while idle; it never tires, and wants no sleep; it is not subject to malady when originally well made, and only refuses to work when worn out with age; it is equally active in all climates, and will do work of any kind; it is a water-pumper, a miner, a sailor, a cotton-spinner, a weaver, a blacksmith, a miller, etc., etc.; and a small engine, in the character of a steam *pony*, may be seen dragging after it on a *rail-road* a hundred tons of merchandise, or a regiment of soldiers, with greater speed than that of our fleetest coaches. It is the king of machines, and a permanent realization of the genii of Eastern fable, whose supernatural powers were occasionally at the command of man."

10. *Frank.* Dr. Arnott speaks of a steam *pony* which is used on a *rail-road*. This must be the very *pony* which gave the poet Saxe such a pleasant "ride on the rail,"

"Singing through the forests,
Rattling over ridges,
Shooting under arches,
Rumbling over bridges;
Whizzing through the mountains,
Buzzing o'er the vale,
Bless me! this is pleasant,
Riding on the rail!"

11. *Mr. M.* It would have been fortunate if poets had written more on scientific and philosophical subjects, as the lan-

guage of poetry is so well calculated to impress truths on the mind. In addition to the extract from Dr. Arnott, I have one from Lord Jeffrey on the same subject, the steam-engine, which I will read to you.

12. *The Steam-engine.*—"It has become a thing stupendous alike for its force' and its flexibility'; for the prodigious power which it can exert', and the ease, precision, and ductility with which it can be varied, distributed, and applied'. The trunk of an elephant, that can pick up a pin' or rend an oak', is as nothing to it. It can engrave a seal', and crush masses of obdurate metal before it'; draw out, without breaking, a thread as fine as gossamer', and lift up a ship of war like a bauble in the air'. It can embroider muslin' and forge anchors'; cut steel into ribbons', and impel loaded vessels against the fury of the winds and waves'.

But I perceive, George, that you also have something which you wish to read. If it has any connection with this subject, we will hear it if you please, and let it conclude this lesson.

George. It is a few verses from a little poem entitled

THE SONG OF STEAM, by G. W. CUTLER.

13. Harness me down with your iron bands,
 Be sure of your curb and rein,
 For I scorn the power of your puny hands
 As the tempest scorns a chain.
 How I laughed, as I lay concealed from sight
 For many a countless hour,
 ● the childish boast of human might,
 And the pride of human power.
14. Ha! ha! ha! they found me at last,
 They invited me forth at length,
 And I rushed to my throne with a thunder-blast,
 And laughed in my iron strength.
 Oh then ye saw a wondrous change
 On earth and ocean wide,
 Where now my fiery armies range,
 Nor wait for wind nor tide.
15. Hurra! hurra! the waters o'er
 The mountain's steep decline;
 Time, space, have yielded to my power,
 The world! the world is mine!
 The rivers the sun hath earliest bless'd,
 And those where his beams decline,
 The giant streams of the queenly west,
 And the orient floods divine.
16. I blow the bellows, I forge the steel,
 In all the shops of trade;
 I hammer the ore, and turn the wheel ●
 Where my arms of strength are made;
 I manage the furnace, the mill, the mint,
 I carry, I spin, I weave;
 And all my doings I put in print
 On every Saturday eve.
17. I've no muscle to weary, no breast to decay,
 No bones to be laid on the shelf;
 And soon I intend you may go and play,
 While I manage this world myself.
 But, harness me down with your iron bands,
 Be sure of your curb and rein,
 For I scorn the strength of your puny hands,
 As the tempest scorns a chain.

SEVENTH MISCELLANEOUS DIVISION.



LESSON I.—BLESSINGS ON CHILDREN.

1. **BLESSINGS** on the blessing children, sweetest gifts of Heaven to earth,
Filling all the heart with gladness, filling all the house with mirth ;
Bringing with them native sweetness, pictures of the primal bloom
Which the bliss forever gladdens, of the region whence they come ;
Bringing with them joyous impulse of a state withouten care,
And a buoyant faith in being, which makes all in nature fair ;
Not a doubt to dim the distance, not a grief to vex the night,
And a hope that in existence finds each hour a luxury ;
Going singing, bounding, brightening—never fearing as they go,
That the innocent shall tremble, and the loving find a foe ;

In the daylight, in the starlight, still with thought that freely flies,
 Prompt and joyous, with no question of the beauty in the skies;
 Genial fancies winning raptures, as the bee still sucks her store,
 All the present still a garden glean'd a thousand times before;
 All the future but a region where the happy serving thought,
 Still depicts a thousand blessings, by the wingéd hunter caught;
 Life a chase where blushing pleasures only seem to strive in flight,
 Linger to be caught, and yielding gladly to the proud delight;
 As the maiden, through the alleys, looking backward as she flies,
 Woos the fond pursuer onward, with the love-light in her eyes.

2. Oh! the happy life in children, still restoring joy to ours,
 Making for the forest music, planting for the wayside flowers;
 Back recalling all the sweetness, in a pleasure pure as rare,
 Back the past of hope and rapture bringing to the heart of care.
 How, as swell the happy voices, bursting through the shady grove,
 Memories take the place of sorrows, time restores the sway to love!
 We are in the shouting comrades, shaking off the load of years,
 Thought forgetting, strifes and trials, doubts, and agonies, and tears;
 We are in the bounding urchin, as o'er hill and plain he darts,
 Share the struggle and the triumph, gladdening in his heart of hearts;
 What an image of the vigor and the glorious grace we knew,
 When to eager youth from boyhood at a single bound we grew!
 Even such our slender beauty, such upon our cheek the glow,
 In our eyes the life of gladness—of our blood the overflow,
 Bless the mother of the urchin! in his form we see her truth:
 He is now the very picture of the memories in our youth;
 Never can we doubt the forehead, nor the sunny flowing hair,
 Nor the smiling in the dimple speaking chin and cheek so fair:
 Bless the mother of the young one! he hath blended in his grace,
 All the hope, and joy, and beauty, kindling once in either face!
3. Oh! the happy faith of children, that is glad in all it sees,
 And with never need of thinking, pierces still its mysteries;
 In simplicity profoundest, in their soul abundance bless'd,
 Wise in value of the sportive, and in restlessness at rest;
 Lacking every creed, yet having faith so large in all they see,
 That to know is still to gladden, and 'tis rapture but to be.
 What trim fancies bring them flowers; what rare spirits walk their wood,
 What a wondrous world the moonlight harbors of the gay and good!
 Unto them the very tempest walks in glories grateful still,
 And the lightning gleams, a seraph, to persuade them to the hill:
 'Tis a sweet and loving spirit, that throughout the midnight rains,
 Broods beside the shutter'd windows, and with gentle love complains,
 And how wooing, how exalting, with the richness of her dyes,
 Spans the painter of the rainbow, her bright arch along the skies,
 With a dream like Jacob's ladder, showing to the fancy's sight,
 How 'twere easy for the sad one to escape to worlds of light!
 Ah! the wisdom of such fancies, and the truth in every dream,
 That to faith confiding offers, cheering every gloom, a gleam!
 Happy hearts, still cherish fondly each delusion of your youth,
 Joy is born of well believing, and the fiction wraps the truth.

W. G. SUMMS

LESSON II.—THE SARACEN BROTHERS.

SALADIN—MALEK ADHEL—ATTENDANT.

Attendant. A stranger craves admittance to your highness.*Saladin.* Whence comes he?*Attendant.* That I know not.

Enveloped with a vestment of strange form,
 His countenance is hidden; but his step,
 His lofty port, his voice in vain disguised,
 Proclaim—if that I dare pronounce it—

Saladin. Whom?*Attendant.* Thy royal brother!*Saladin.* Bring him instantly. [*Exit Attendant.*]

Now, with his specious, smooth, persuasive tongue,
 Fraught with some wily subterfuge, he thinks
 To dissipate my anger. He shall die!

[*Enter Attendant and Malek Adhel.*]Leave us together. [*Exit Attendant.*] [*Aside.*] I should know that form.

Now summon all thy fortitude, my soul,
 Nor, though thy blood cry for him, spare the guilty!

[*Aloud.*] Well stranger, speak; but first unveil thyself,
 For Saladin must view the form that fronts him.

Malek Adhel. Behold it, then!*Saladin.* I see a traitor's visage.*Malek Adhel.* A brother's!*Saladin.* No!

Saladin owns no kindred with a villain.

Malek Adhel. Oh, patience, Heaven! Had any tongue but thine
 Uttered that word, it ne'er should speak another.

Saladin. And why not now? Can this heart be more pierced

By Malek Adhel's sword than by his deeds?

Oh, thou hast made a desert of this bosom!

For open candor, planted sly disguise;

For confidence, suspicion; and the glow

Of generous friendship, tenderness, and love,

Forever banished! Whither can I turn,

When he by blood, by gratitude, by faith,

By every tie, bound to support, forsakes me?

Who, who can stand, when Malek Adhel falls?

Henceforth I turn me from the sweets of love:

The smiles of friendship, and this glorious world,

In which all find some heart to rest upon,

Shall be to Saladin a cheerless void—

His brother has betrayed him!

Malek Adhel. Thou art softened;

I am thy brother, then; but late thou saidst—

My tongue can never utter the base title!

Saladin. Was it traitor? True!

Thou hast betrayed me in my fondest hopes!

Villain? 'Tis just; the title is appropriate!

Dissembler? 'Tis not written in thy face;

No, nor imprinted on that specious brow ;
But on this breaking heart the name is stamped,
Forever stamped, with that of Malek Adhel !
Thinkest thou I'm softened ? By Mohammed ! these hands
Shall crush these aching eyeballs ere a tear
Fall from them at thy fate ! Oh monster, monster !
The brute that tears the infant from its nurse
Is excellent to thee ; for in his form
The impulse of his nature may be read ;
But thou, so beautiful, so proud, so noble,
Oh, what a wretch art thou ! Oh, can a term
In all the various tongues of man be found
To match thy infamy ?

Malek Adhel. Go on ! go on !
'Tis but a little time to hear thee, Saladin ;
And, bursting at thy feet, this heart will prove
Its penitence, at least.

Saladin. That were an end
Too noble for a traitor ! The bowstring is
A more appropriate finish ! Thou shalt die !
Malek Adhel. And death were welcome at another's mandate !
What, what have I to live for ? Be it so,
If that, in all thy armies, can be found
An executing hand.

Saladin. Oh, doubt it not !
They're eager for the office. Perfidy,
So black as thine, effaces from their minds
All memory of thy former excellence.

Malek Adhel. Defer not, then, their wishes. *Saladin,*
If e'er this form was joyful to thy sight,
This voice seemed grateful to thine ear, accede
To my last prayer : Oh, lengthen not this scene,
To which the agonies of death were pleasing !
Let me die speedily !

Saladin. This very hour !
[*Aside.*] For oh ! the more I look upon that face,
The more I hear the accents of that voice,
The monarch softens, and the judge is lost
In all the brother's weakness ; yet such guilt—
Such vile ingratitude—it calls for vengeance ;
And vengeance it shall have ! What ho ! who waits there ?

[*Enter Attendant.*]

Attendant. Did your highness call ?

Saladin. Assemble quickly
My forces in the court. Tell them they come
To view the death of yonder bosom traitor.
And bid them mark, that he who will not spare
His brother when he errs, expects obedience—
Silent obedience—from his followers. [*Exit Attendant.*]

Malek Adhel. Now, Saladin,
The word is given ; I have nothing more
To fear from thee, my brother. I am not
About to crave a miserable life.
Without thy love, thy honor, thy esteem,

Life were a burden to me. Think not, either,
 The justness of thy sentence I would question,
 But one request now trembles on my tongue—
 One wish still clinging round the heart, which soon
 Not even that shall torture—will it, then,
 Thinkest thou, thy slumbers render quieter,
 Thy waking thoughts more pleasing, to reflect,
 That when thy voice had doomed a brother's death,
 The last request which e'er was his to utter
 Thy harshness made him carry to the grave?
Saladin. Speak, then; but ask thyself if thou hast reason
 To look for much indulgence here.

Malek Adhel. I have not;
 Yet will I ask for it. We part forever;
 This is our last farewell; the king is satisfied;
 The judge has spoke the irrevocable sentence.
 None sees, none hears, save that Omniscient Power,
 Which, trust me, will not frown to look upon
 Two brothers part like such. When, in the face
 Of forces once my own, I'm led to death,
 Then be thine eye unmoistened; let thy voice
 Then speak my doom untrembling; then,
 Unmoved, behold this stiff and blackened corse.
 But now I ask—nay, turn not, Saladin—
 I ask one single pressure of thy hand;
 From that stern eye one solitary tear—
 Oh, torturing recollection!—one kind word
 From the loved tongue which once breathed naught but kindness.
 Still silent? Brother! friend! beloved companion
 Of all my youthful sports!—are they forgotten?—
 Strike me with deafness, make me blind, O Heaven!
 Let me not see this unforgiving man
 Smile at my agonies! nor hear that voice
 Pronounce my doom, which would not say one word,
 One little word, whose cherished memory
 Would soothe the struggles of departing life!
 Yet, yet thou wilt! Oh, turn thee, Saladin!
 Look on my face—thou canst not spurn me then;
 Look on the once-loved face of Malek Adhel
 For the last time, and call him—

Saladin. [*Seizing his hand.*] Brother! brother!

Malek Adhel. [*Breaking away.*] Now call thy followers;
 Death has not now

A single pang in store. Proceed! I'm ready.

Saladin. Oh, art thou ready to forgive, my brother?
 To pardon him who found one single error,
 One little failing, 'mid a splendid throng
 Of glorious qualities—

Malek Adhel. Oh, stay thee, Saladin!
 I did not ask for life. I only wished
 To carry thy forgiveness to the grave.
 No, emperor, the loss of Cæsarëa
 Cries loudly for the blood of Malek Adhel.
 Thy soldiers, too, demand that he who lost

What cost them many a weary hour to gain,
Should expiate his offenses with his life.
Lo! even now they crowd to view my death,
Thy just impartiality. I go!
Pleased by my fate to add one other leaf
To thy proud wreath of glory. [*Going.*]

Saladin. Thou shalt not. [*Enter Attendant.*]

Attendant. My lord, the troops assembled by your order
Tumultuous throng the courts. The prince's death
Not one of them but vows he will not suffer.
The mutes have fled; the very guards rebel.
Nor think I, in this city's spacious round,
Can e'er be found a hand to do the office.

Malek Adhel. Oh faithful friends! [*To Attendant.*] Thine shall.

Attendant. Mine? Never!
The other first shall lop it from the body.
Saladin. They teach the emperor his duty well.
Tell them he thanks them for it. Tell them, too,
That ere their opposition reached our ears,
Saladin had forgiven Malek Adhel.

Attendant. Oh joyful news!
I haste to gladden many a gallant heart,
And dry the tear on many a hardy cheek,
Unused to such a visitor. [*Exit.*]

Saladin. These men, the meanest in society,
The outcasts of the earth—by war, by nature,
Hardened, and rendered callous—these who claim
No kindred with thee—who have never heard
The accents of affection from thy lips—
Oh, these can cast aside their vowed allegiance,
Throw off their long obedience, risk their lives,
To save thee from destruction. While I,
I, who can not, in all my memory,
Call back one danger which thou hast not shared,
One day of grief, one night of revelry,
Which thy resistless kindness hath not soothed,
Or thy gay smile and converse rendered sweeter—
I, who have thrice in the ensanguined field,
When death seemed certain, only uttered—"Brother!"
And seen that form, like lightning, rush between
Saladin and his foes, and that brave breast
Dauntless exposed to many a furious blow
Intended for my own—I could forget
That 'twas to thee I owed the very breath
Which sentenced thee to perish! Oh, 'tis shameful!
Thou canst not pardon me!

Malek Adhel. By these tears I can!
Oh brother! from this very hour a new,
A glorious life commences! I am all thine!
Again the day of gladness or of anguish
Shall Malek Adhel share; and oft again
May this sword fence thee in the bloody field.
Henceforth, Saladin,
My heart, my soul, my sword, are thine forever!—*New Monthly Mag.*

LESSON III.—OUR COUNTRY AND OUR HOME.

THERE is a land, of every land the pride;
 Beloved by Heaven o'er all the world beside;
 Where brighter suns dispense serener light,
 And milder moons emparadise the night;
 A land of beauty, virtue, valor, truth,
 Time-tutored age, and love-exalted youth.
 The wandering mariner, whose eye explores
 The wealthiest isles, the most enchanting shores,
 Views not a realm so beautiful and fair,
 Nor breathes the spirit of a purer air;
 In every clime, the magnet of his soul,
 Touched by remembrance, trembles to that pole;
 For in this land of Heaven's peculiar grace,
 The heritage of Nature's noblest race,
 There is a spot of earth supremely bless'd,
 A dearer, sweeter spot than all the rest,
 Where man, creation's tyrant, casts aside
 His sword and sceptre, pageantry and pride,
 While in his softened looks benignly blend
 The sire, the son, the husband, father, friend.
 Here woman reigns; the mother, daughter, wife,
 Strew with fresh flowers the narrow way of life;
 In the clear heaven of her delightful eye,
 An angel-guard of loves and graces lie;
 Around her knees domestic duties meet,
 And fireside pleasures gambol at her feet.
 Where shall that *land*—that *spot of earth* be found?
 Art thou a man?—a patriot?—look around;
 Oh! thou shalt find, howe'er thy footsteps roam,
 That land *thy* country, and that spot *thy* home.

JAMES MONTGOMERY.

LESSON IV.—THE GIPSY FORTUNE-TELLER.

1. "HARK, my maiden, and I'll tell you,
 By the power of my art,
 All the things that e'er befell you,
 And the secret of your heart.
2. "How that you love some one—don't you?
 Love him better than you say;
 Won't you hear, my maiden, won't you?
 What's to be your wedding-day?"
3. "Ah, you cheat, with words of honey,
 You tell stories, that you know!
 Where's the husband for my money
 That I gave you long ago'?

4. "Neither silver, gold, nor copper
Shall you get this time from me;
Where's the husband, tall and proper,
That you told me I should see'?"
 5. "Coming still, my maiden, coming,
With two eyes as black as sloes;
Marching soldierly, and humming
Gallant love-songs as he goes."
 6. "Get along, you stupid gipsy!
I won't have your barrack-beau;
Strutting up to me half tipsy,
Saucy—with his chin up—so!"
 7. "Come, I'll tell you the first letter
Of your handsome *sailor's* name—"
"I know every one, that's better,
Thank you, gipsy, all the same."
 8. "Ha! my maiden, runs your text so' ?
Now I see the die is cast;
And the day is—Monday next." "No',
Gipsy', it was—Monday last!"
-

LESSON V.—SUCCESS ALONE SEEN.

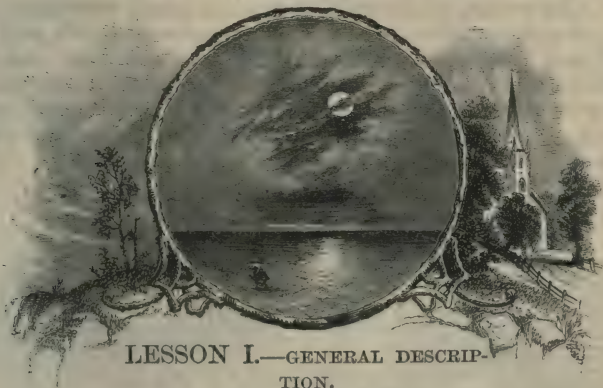
Few know of life's beginnings—men behold
The goal achieved—the warrior, when his sword
Flashes red triumph in the noonday sun;
The poet, when his lyre hangs on the palm;
The statesman, when the crowd proclaim his voice,
And mould opinion on his gifted tongue:
They count not life's first steps, and never think
Upon the many miserable hours
When hope deferred was sickness to the heart.
They reckon not the battle and the march,
The long privations of a wasted youth;
They never see the banner till unfurl'd.
What are to them the solitary nights
Pass'd pale and anxious by the sickly lamp,
Till the young poet wins the world at last
To listen to the music long his own?
The crowd attend the statesman's fiery mind
That makes their destiny; but they do not trace
Its struggle, or its long expectancy.
Hard are life's early steps; and, but that youth
Is buoyant, confident, and strong in hope,
Men would behold its threshold, and despair.

LÆTITIA E. MACLEAN (LONDON).

PART VIII.

FIRST DIVISION OF PHYSICAL GEOGRAPHY.

[This subject is continued in the Sixth Reader.]



LESSON I.—GENERAL DESCRIPTION.

1. GEOGRAPHY is a description of the earth. The numerous subjects embraced in a complete description of our planet are usually arranged under the three great divisions, *Mathematical, Physical, and Political Geography*.

Mathematical Geography has for its object the determination of the form and dimensions of the earth, its relations with the celestial bodies, the relative positions of places on its surface, and the representation of the whole or a part of the surface on maps or globes.

2. *Physical Geography* is a description of the principal features of the earth's surface, as consisting of land and water, the extent, position, and form of continents and islands, the elevation and direction of mountain ranges, the phenomena of volcanoes and earthquakes, the conformation of plains and valleys, and the soil, climate, and productions of different regions. The currents of the ocean and of the atmosphere, with their attendant phenomena, are also embraced in the department of Physical Geography.

3. *Political Geography* considers the earth as the abode of man, and describes the various nations in their local relations. This division of the science is what is usually studied in schools as Geography.

As the form of the earth is spherical, it is impossible to represent any considerable portion of its surface on a plane without making some parts appear larger than they are, relatively to others. In maps commonly used in schools, the world is represented in two circles, called the eastern and western hemispheres.

4. The surface of the globe comprises nearly two hundred million square miles, of which only about one fourth part is land, and considerably more than half of this is in the eastern hemisphere. The accompanying chart shows about three times as much land north of the equator as south of it; and it will also be observed that nearly one half of all the land is in the northern temperate zone.



Water Hemisphere.

Land Hemisphere.

5. If we draw a map with London for the centre of the circle or horizon, which is nearly that of the land hemisphere above represented, we shall include more land than if any other city were taken as a centre, and consequently in the opposite hemisphere there will be more water. In other words, there is more land within 6000 miles of London than within that distance of any other city on the globe. It is often said that certain cities have an extensive "back country" on which they depend for support, and it is an interesting fact that London, the commercial metropolis of the world, has a greater "back country," within the distance of one fourth the earth's circumference, than any other city on the globe.

6. There is a method of representing the earth's surface called *Mercator's projection*. This method, which is universally adopted for nautical charts, and has many advant-

ages for *physical maps*, has the meridian lines straight, equidistant, and parallel. The parallels of latitude are also straight lines perpendicular to the meridians; but their distances increase from the equator in such proportions as always to show the true bearings of places from one another.*

7. In using Mercator's chart, it must be remembered that it does not truly represent the figure, or relative magnitude of countries, especially those far from the equator. In this kind of chart the surface of the earth is represented as if it were the convex surface of a cylinder, spread out on a level or plain, and the western continent is often shown on the right side of the map.

LESSON II.—CONTINENTS AND ISLANDS.

1. THERE are three great masses of land on the earth's surface, which, as they are surrounded by water, might be termed islands, but two of these are commonly called continents. These three great divisions are the Old continent, embracing Europe, Asia, and Africa; the New continent, including North and South America; and the island of Australia.

2. The two continents differ remarkably in their general features. In the Eastern continent the general direction of the land and of the great chain of mountains is from east to west, nearly parallel with the equator. In the Western continent the direction of the land is from north to south, or perpendicular to the equator. The Western continent is not quite half as large as the Eastern, but it has about five times the area of Australia.

3. Another notable feature of the land is, that all the great peninsulas are nearly triangular in shape, and are pointed toward the south. Such is the case with Africa, South America, Arabia, Hindostan, Corea, Kamtschatka, California, Greenland, and Florida; a circumstance which the celebrated geologist, Dr. Buckland, has attributed to the wearing away of the land by the waters of the ocean, which he supposes to have been projected northward from the southern hemisphere with great force by some sudden convulsion of the globe. The only exceptions to this generalization are Yucatan and Jutland, which are alluvial formations, and owe their structure to influences which have not operated in shaping the great continental masses.

* The physical chart of North America, on page 378, is drawn on the plan of *Mercator's projection*.

4. Each continent has an island or group of islands a little east of its southern extremity; thus South America has its Falkland Islands, and Africa its Madagascar. So also Ceylon is similarly situated in respect to Hindostan; Iceland to Greenland; the Bahamas to Florida; and Tasmania and New Zealand to Australia.

5. It has been observed, as another peculiarity of the structure of peninsulas, that they generally terminate abruptly in bluffs, promontories, or mountains. Thus, at the southern extremity of Africa, the Cape of Good Hope stands out as a rocky barrier, where, in some great convulsion of the globe, the waters of the ocean were stayed; the high, black, and precipitous promontory of Cape Horn is the visible termination of the Andes; and the extremity of the Ghauts Mountains, in Hindostan, is Cape Comorin. There is also a striking analogy between the unbroken coast-line of South America and Africa, while North America resembles Europe in its coast indentations of bays and gulfs.

6. It is important that a commercial city should have ample wharf-room, which is usually increased artificially, as far as possible, in the construction of slips, piers, and wharves. A similar advantage is presented in the indentation of a coast by seas, gulfs, and bays. In this respect Europe is most fortunate, having one mile of sea-coast for every 156 square miles of surface, while less favored Africa has the same coast-line for every 623 square miles of territory. Next to Europe, North America has the greatest proportionate extent of coast, being one mile for every 350 square miles of surface. "Africa," says Prof. Guyot, "is nearly ellipsoidal, and concentrated upon itself. It thrusts into the ocean no important peninsula, nor any where lets into its bosom the waters of the sea. It seems to close itself against every influence from without."

7. Though the countless islands scattered over the globe appear so various in size, form, and character, they have been grouped into two distinct classes, called *continental* and *pelagic*. Continental islands occur along the margin of continents, which they resemble in geological situation, and are usually long in proportion to their breadth. They seem to have been formed at the same time as the continents, and possibly were once joined to the main land, having been separated by the action of the sea. It may be that the positions of continental islands mark the former boundaries of the continents. Vancouver's Island, on the western coast of Amer-

ica, and the islands from Chiloe to Cape Horn, also the West Indies, England and Scotland, Corsica and Sardinia, and Madagascar, are good examples of continental islands.

8. Pelagic islands are mostly volcanic or coral formations which have risen from the bed of the ocean, far from land, and independent of the continents. In form they are generally round, and are mostly found in groups. Single pelagic islands, like St. Helena, are rare. Although they sometimes rise thousands of feet above the sea, they are probably the tops of mountains whose bases are far down in the fathomless retreats of the ocean.



Formation of Graham Island, as seen from a distance.

9. In July, 1831, a new volcanic island appeared near Sicily, in the Mediterranean Sea, caused by the bursting forth of a volcano. An island was formed there with a crater in its centre. This was called Graham Island; and although it rose from a part of the sea where the water was 100 fathoms deep, and continued to grow till it was three miles in circumference and above 200 feet high, it afterward gradually diminished in size, and finally, after

a few weeks, disappeared beneath the waves.

LESSON III.—CORAL ISLANDS AND REEFS.

1.

DEEP in the wave is a coral grove,
Where the purple mullet and gold-fish rove,
Where the sea-flower spreads its leaves of blue,
That never are wet with falling dew,
But in bright and changeful beauty shine,
Far down in the green and glassy brine.—PERCIVAL.

2. The "great and wide sea, wherein are things creeping innumerable, both small and great beasts," contains countless multitudes of living beings scarcely larger than a pin's head, which are constantly engaged in taking from the sea-water the lime it holds in solution, and, in the form of "coral groves," building up islands and reefs, some of which are a thousand miles in extent. Prof. Dana calculates that there are in the

South Sea nearly 300 coral islands, the work of these "jelly-like specks."

3. There are four different kinds of coral formations in the Pacific and Indian Oceans, called *lagoon islands* or *atolls*, *encircling reefs*, *barrier reefs*, and *coral fringes*. They are nearly all confined to tropical regions; the *atolls* to the Pacific and Indian Oceans alone. Atolls, of which the annexed



An atoll of the Pacific Ocean, covered with vegetation.

cut is a fair representation, consist of a circular ring of coral surrounding a shallow lake or lagoon of water. Encircling reefs surround mountainous islands at some distance from the shore. Barrier reefs are similar, but differ in their position in respect to the land. The largest barrier reef is the Australian, which extends more than 1000 miles.

4. On these bare reefs of coral the storms and waves of the ocean gradually deposit mud, sand, and sea-weed, until at length a kind of soil is formed. Seeds from the neighboring or distant lands are driven to the desolate isle, and, finding a soil suited to them, germinate and grow, until finally the ocean rock is covered with verdure. The mariner has visited the "sea-snatched isle," and

"Wandered where the dreamy palm
Murmured above the sleeping wave:
And through the waters clear and calm
Looked down into the coral cave,
Whose echoes never had been stirred
By breath of man or song of bird."

5. The whole of the Pacific Ocean is crowded with islands of the same architecture, the produce of the same insignificant architects. An animal barely possessing life, scarcely appearing to possess volition, tied down to its narrow cell, ephemeral in existence, is daily, hourly creating the habitations of

men, of animals, of plants. In the vast Pacific it is founding a new continent; it is constructing a new world. This process is equally visible in the Red Sea, which is daily becoming less and less navigable, in consequence of the growth of its coral rocks; and the day is to come when perhaps one plain will unite the opposed shores of Egypt and Arabia.

6. These are among the wonders of His mighty hand: such are among the means which He uses to forward His ends of benevolence. Yet man, vain man, pretends to look down on the myriads of beings equally insignificant in appearance, because he has not yet discovered the great offices which they hold, the duties which they fulfill in the great order of nature.

LESSON IV.—THE CORAL INSECT.*

[The representations here given are the united *stony cells* or *habitations* of the coral-building zoophytes, each species having its own peculiar structure. Every minute portion of this calcareous or lime rock is more or less surrounded by a soft animal substance (the zoophyte), capable of expanding itself, but otherwise fixed to its habitation; yet, when alarmed, it has the power of contracting itself almost entirely into the cells and hollows of the hard coral. These soft parts become, when taken from the sea, nothing more in appearance than a brown slime spread over the stony nucleus. Yet these jelly-like animals are the builders of the coral reefs. See *Seventh Reader* for a description of this class of animals.]



COMMON CORAL-BUILDING ZOOPHYTES.—1. *Meandrina labyrinthica*. 2. *Astrea dipsacea*. 3. *Madrepora muricata*. 4. *Porites clavaria*. 5. *Caryophyllia fastigiata*. 6. *Oculina hirtella*.

1. TOIL on! toil on! ye ephemeral train,
Who build in the tossing and treacherous main;
Toil on—for the wisdom of man ye mock,
With your sand-based structures and domes of rock;
Your columns the fathomless fountains lave,
And your arches spring up to the crested wave;
Ye're a puny race thus to boldly rear
A fabric so vast in a realm so drear.
2. Ye bind the deep with your secret zone,
The ocean is sealed, and the surge a stone;
Fresh wreaths from the coral pavement spring,
Like the terraced pride of Assyria's king;

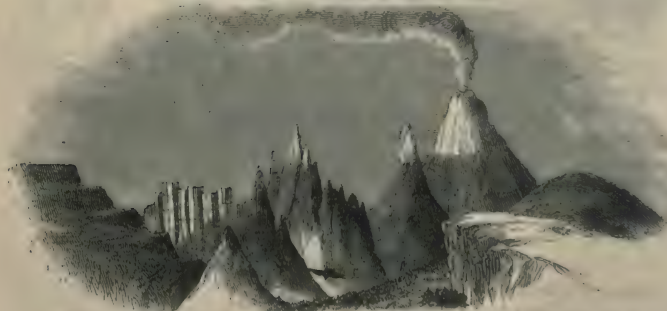
* The little coral-building animal, or *polyp*, was long ago called the coral *insect*, a term quite improper, but one that is still retained in popular use.

The turf looks green where the breakers rolled ;
 O'er the whirlpool ripens the rind of gold ;
 The sea-snatched isle is the home of men,
 And mountains exult where the wave hath been.

3. But why do ye plant 'neath the billows dark
 The wrecking reef for the gallant bark ?
 There are snares enough on the tented field,
 'Mid the blossomed sweets that the valleys yield ;
 There are serpents to coil ere the flowers are up ;
 There's a poison-drop in man's purest cup ;
 There are foes that watch for his cradle breath,
 And why need ye sow the floods with death ?
4. With mouldering bones the deeps are white,
 From the ice-clad pole to the tropics bright ;
 The mermaid hath twisted her fingers cold
 With the mesh of the sea-boy's curls of gold,
 And the gods of ocean have frowned to see
 The mariner's bed in their halls of glee ;
 Hath earth no graves, that ye thus must spread
 The boundless sea for the thronging dead ?
5. Ye build—ye build—but ye enter not in,
 Like the tribes whom the desert devoured in their sin ;
 From the land of promise ye fade and die,
 Ere its verdure gleams forth on your weary eye ;
 As the kings of the cloud-crowned pyramid,
 Their noteless bones in oblivion hid,
 Ye slumber unmarked 'mid the desolate main,
 While the wonder and pride of your works remain.

MRS. SIGOURNEY.

LESSON V.—MOUNTAINS.



Terraced.

Columnar.

Serrated.

Peaked.

Volcanic.

Dome-shaped.

FORMS OF MOUNTAINS.

1. Thou, who would'st see the lovely and the wild
 Mingled in harmony, on Nature's face,
 Ascend our rocky mountains. Let thy foot

Fail not with weariness ; for on their tops
 The beauty and the majesty of earth,
 Spread wide beneath, shall make thee to forget
 The steep and toilsome way. There, as thou stand'st,
 The haunts of men below thee, and above,
 The mountain summits, thy expanding heart
 Shall feel a kindred with that loftier world
 To which thou art translated, and partake
 The enlargement of thy vision. Thou shalt look
 Upon the green and rolling forest tops,
 And down into the secrets of the glens
 And streams, that, with their bordering thickets, strive
 To hide their windings. Thou shalt gaze at once,
 Here on white villages, and tilth, and herds,
 And swarming roads ; and there, on solitudes
 That only hear the torrent, and the wind,
 And eagle's shriek.—BRYANT.

2. "There is a charm," says Howitt, "connected with mountains, so powerful that the merest mention of them, the merest sketch of their magnificent features, kindles the imagination, and carries the spirit at once into the bosom of their enchanted regions. How the mind is filled with their vast solitude ! how the inward eye is fixed on their silent, their sublime, their everlasting peaks ! How our heart bounds to the music of their solitary cries, to the tinkle of their gushing rills, to the sound of their cataracts !

3. "When we let loose the imagination, and give it free charter to range through the glorious ridges of continental mountains, through Alps, Apennines, or Andes, how is it possessed and absorbed by all the awful magnificence of their scenery and character ! by the sky-ward and inaccessible pinnacles, the

"Palaces where nature thrones
 Sublimity in icy halls !"

the dark Alpine forests ; the savage rocks and precipices ; the fearful and unfathomable chasms filled with the sound of ever-precipitating waters ; the cloud, the silence, the avalanche, the cavernous gloom, the terrible visitations of heaven's concentrated lightning, darkness, and thunder ; or the sweeter features of living, rushing streams, spicy odors of flower and shrub, fresh spirit-elating breezes sounding through the dark pine grove ; the ever-varying lights and shadows, and aerial hues ; the wide prospects, and, above all, the simple inhabitants !"

4. But beyond their moral grandeur and their charms of scenery, mountains subserve some very important purposes in the great economy of nature. Their influence upon the temperature and fertility of vast regions, and upon the formation and direction of clouds and air-currents, will be noticed in the lessons on the atmosphere. They are also the most com-

mon boundaries of nations. Frequently the language spoken by the dwellers on one side of a mountain is unintelligible to the inhabitants of the other slope. And not only the language, but the moral, social, and political condition of man is influenced by the bold and picturesque scenery of mountain peaks,

"That wear their caps of snow
In very presence of the regal sun."

5. Mountains on land, like mountains in the sea whose tops we call islands when they appear above the water, are seldom found detached or insulated. Sometimes, though rarely, they exist in aggregated groups, extending from a common centre and not externally connected; but most commonly they are in ranges or mountain chains, traversing extensive regions.

6. The great mountain ranges generally follow the direction of the continents, and it is to this circumstance that all large countries owe their peculiarities of climate and productions. "Suppose," said Guyot, "the Andes, transferred to the eastern coast of South America, hindered the trade-winds from bearing the vapors of the ocean into the interior of the continent, the plains of the Amazon and of Paraguay would be nothing but a desert."

7. When mountain chains occur near coasts, it has been observed that their slope is steeper toward the ocean than toward the interior. It has also been remarked that the mountains of the Eastern continent have their long slopes toward the north, and the steep or short slopes toward the south. In the Western continent the long slopes are toward the east, and the short slopes toward the west. The highest peak in the world, as far as ascertained, is Mount Everest, one of the Himalayas, which is 29,000 feet in altitude. Chimborazo, the most elevated point ever reached by man, is 19,700 feet in height. Mount St. Elias, which is 17,860 feet in height, is the highest point in North America.

8. The Alps, famous in the records of military achievements as having been crossed by the armies of Hannibal and Napoleon, and pre-eminent for the picturesque grandeur of their scenery, are the most celebrated of all mountain elevations, and the highest in Europe. Mount Blanc, the loftiest peak, is an enormous mass of granite, reaching the height of 15,750 feet, the ascent to which is rendered exceedingly difficult by the surrounding walls of ice, fearful precipices, and the everlasting snows by which it is covered; yet its sum-

mit has often been reached by adventurous tourists and men of science. The thoughts very naturally suggested to a contemplative mind by a view of these "proud monuments of God" are very happily expressed in the following lines:

THE ALPS.—WILLIS GAYLORD CLARK.

9. Proud monuments of God! sublime ye stand
Among the wonders of his mighty hand:
With summits soaring in the upper sky,
Where the broad day looks down with burning eye;
Where gorgeous clouds in solemn pomp repose,
Flinging rich shadows on eternal snows:
Piles of triumphant dust, ye stand alone,
And hold, in kingly state, a peerless throne!
10. Like olden conquerors, on high ye rear
The regal ensign and the glittering spear:
Round icy spires the mists, in wreaths unrolled,
Float ever near, in purple or in gold;
And voiceful torrents, sternly rolling there,
Fill with wild music the unpillared air:
What garden, or what hall on earth beneath,
Thrills to such tones as o'er the mountains breathe?
11. There, through long ages past, those summits shone
When morning radiance on their state was thrown;
There, when the summer day's career was done,
Played the last glory of the sinking sun;
There, sprinkling lustre o'er the cataract's shade,
The chastened moon her glittering rainbow made;
And, blent with pictured stars, her lustre lay,
Where to still vales the free streams leaped away.
12. Where are the thronging hosts of other days,
Whose banners floated o'er the Alpine ways;
Who, through their high defiles, to battle wound,
While deadly ordnance stirred the heights around?
Gone; like the dream that melts at early morn,
When the lark's anthem through the sky is borne:
Gone; like the wrecks that sink in ocean's spray,
And chill Oblivion murmurs, Where are they?
13. Yet "Alps on Alps" still rise; the lofty home
Of storms and eagles, where their pinions roam;
Still round their peaks the magic colors lie,
Of morn and eve, imprinted on the sky;
And still, while kings and thrones shall fade and fall,
And empty crowns lie dim upon the pall—
Still shall their glaciers flash; their torrents roar;
Till kingdoms fall, and nations rise no more.

14. Great as the elevations of mountains seem to us, they are small compared with the globe itself. A grain of sand on a twelve-inch globe would represent a mountain relatively much higher than the loftiest of the Himalayas. And so small a portion of the globe is the sum of all the mountains, that its diameter would be but slightly increased if they were leveled to their bases, and spread over its surface.

15. Yet, comparatively slight as these elevations are, showing the narrow range, in point of elevation from the sea-level, to which man is confined, they furnish him by far the best opportunities which he has for observing the phenomena of na-

ture; and of all mountains, those of the torrid zone are the best adapted for this purpose. The celebrated traveler and naturalist, Humboldt, has the following remarks on this subject:

16. "Among the colossal mountains of Quito and Peru, furrowed by deep ravines, man is enabled to contemplate alike all the families of plants, and all the stars of the firmament. There, at a single glance, the eye surveys majestic palms, humid forests of bambusa, and the varied species of musaceæ; while above these forms of tropical vegetation appear oaks, medlars, the sweet-brier, and umbelliferous plants, as in our European homes. There, as the traveler turns his eyes to the vault of heaven, a single glance embraces the constellation of the Southern Cross, the Magellanic clouds, and the guiding stars of the constellation of the Bear, as they circle round the arctic pole. There the depths of the earth and the vaults of heaven display all the richness of their forms and the variety of their phenomena. There the different climates are ranged the one above the other, stage by stage, like the vegetable zones, whose succession they limit; and there the observer may readily trace the laws that regulate the diminution of heat, as they stand indelibly inscribed on the rocky walls and abrupt declivities of the Cordilleras."

17. Let these remarks suggest to the reader how much of interest the various aspects of nature present to the observant eye of the philosopher, and how much a knowledge of the laws of nature is calculated to contribute to our intellectual pleasures.

LESSON VI.—TABLE-LANDS, PLAINS, AND VALLEYS.

1. THE earth's surface exhibits great variety in aspect, forming mountains, hills, table-lands, plains, and valleys. The most general of these features are what geographers term *table-lands* or *plateaus*, and *lowlands* or *plains*.

2. In considering the climate, and, consequently, the products of a country, it is necessary to observe its altitude above the ocean level, as well as its distance from the equator. A difference of 350 feet vertically is equal to a difference of 60 miles horizontally in a direction north and south. The mean temperature of a place at an elevation of 350 feet corresponds to the mean temperature of a location 60 miles farther north and on the sea-level. In tropical regions the elevated table-lands have frequently a rich soil and the most genial climate, affording to man a delightful and picturesque abode.

3. Unquestionably the most extensive plateau in the world is the lofty table-land of Central Asia, which is from five thousand to fifteen thousand feet high. Bounded and inter-

sected by lofty mountain ranges, having the great Altaian chain on the north, and the Himalayas and Mountains of China on the south and east, it is without a single opening to the sea, and its water system consists of lakes without outlets, the final recipients of many rivers. The largest of these inland lakes or seas are the Caspian and the Aral, in both of which the waters are salt, though less so than those of the ocean.

4. While the Eastern continent is remarkable for its tablelands, ours is the land of plains, which form two thirds of the surface of the Western world. South America, with the exception of the long, narrow table-land of the Andes, may be considered one vast plain, divided into three principal portions—the *llanos*, or low grassy plains of the Orinoco and its tributaries; the *selvas*, or forest plains, which make the great basin of the Amazon; and the *pampas*, or level plains of the La Plata. In the wet season the grassy plains of South America are covered with the most luxuriant vegetation, but in the dry months they present the appearance of a wide waste of desolation.

5. North America has its plateau, which extends along the eastern side of the Rocky Mountains, and includes the tablelands of Utah and Mexico; but the most remarkable feature in its physical conformation is its vast central plain, the largest, not of America only, but of the world. It embraces the basin of the Mississippi and its tributaries, together with the basins of the St. Lawrence and the great lakes, and, stretching away far to the north, it approaches the borders of the Frozen Sea. Nearly all of its northern portion, north of the fiftieth degree of latitude, is a bleak and barren waste, occupied by numerous lakes, and bearing a striking resemblance to northern Asia; but its more southern portion, “the Valley of the Mississippi,” not only enjoys a happy climate, but is one of the most fertile regions in the world, capable of sustaining an immense population, and doubtless destined to be the seat of a vast empire. “Who does not see,” says Guyot, “that here is the character of America—that here lies the future of the New World; while the countries of mountains and plateaus seem destined to play only a secondary part?”

6. The accompanying chart of a large portion of North America will give a very correct idea of the physical configuration of the country, showing the comparative elevations of its different parts above the ocean level. Yet the elevations on this chart are 120 times enlarged beyond their true

relative height as compared with the scale on which the map itself is drawn, showing that the loftiest mountains are quite insignificant when we compare them with the size of the great globe itself.

7. Portions of the great North American plain, in the valleys of the Missouri and Mississippi, and also in Texas, are called *prairies*, a word signifying *meadows*. These natural



meadow-lands, covered chiefly with grass, and presenting, in the summer season, the grandest display of floral vegetation which the sun looks down upon, are grouped in three divisions, as *bushy* prairies, *wet* or swampy prairies, and *rolling* prairies. It is the latter, more particularly, which are described in the following lesson as the “gardens of the desert”—“island groves hedged round with forests.”

LESSON VII.—THE PRAIRIES.



THESE are the gardens of the desert, these
 The unshorn fields, boundless and beautiful,
 For which the speech of England has no name—
 The prairies. I behold them for the first,
 And my heart swells, while the dilated sight
 Takes in the encircling vastness. Lo! they stretch
 In airy undulations far away,
 As if the ocean, in his gentlest swell,
 Stood still, with all his rounded billows fixed,
 And motionless forever. Motionless?
 No—they are all unchained again. The clouds
 Sweep over with their shadows, and, beneath,
 The surface rolls and fluctuates to the eye;
 Dark hollows seem to glide along and chase
 The sunny ridges. Breezes of the south!
 Who toss the golden and the flame-like flowers,
 And pass the prairie-hawk that, poised on high,
 Flaps his broad wings, yet moves not—ye have played
 Among the palms of Mexico and vines
 Of Texas, and have crisped the limpid brooks
 That from the fountains of Sonora glide
 Into the calm Pacific—have ye fanned
 A nobler or a lovelier scene than this?
 Man hath no part in all this glorious work:
 The hand that built the firmament hath heaved
 And smoothed these verdant swells, and sown their slopes
 With herbage, planted them with island groves,
 And hedged them round with forests. Fitting floor
 For this magnificent temple of the sky—
 With flowers whose glory and whose multitude

Rival the constellations! The great heavens
Seem to stoop down upon the scene in love—
A nearer vault, and of a tenderer blue,
Than that which bends above the eastern hills.
As o'er the verdant waste I glide my steed,
Among the high, rank grass that sweeps his sides,
The hollow beating of his footstep seems
A sacrilegious sound. I think of those
Upon whose rest he tramples. Are they here—
The dead of other days?—and did the dust
Of these fair solitudes once stir with life
And burn with passion? Let the mighty mounds*
That overlook the rivers, or that rise
In the dim forest, crowded with old oaks,
Answer. A race that long has passed away
Built them; a disciplined and populous race
Heaped, with long toil, the earth, while yet the Greek
Was hewing the Pentelicus to forms
Of symmetry, and rearing on its rock
The glittering Parthenon. These ample fields
Nourished their harvests; here their herds were fed,
When haply by their stalls the bison lowed,
And bowed his mané shoulder to the yoke.
All day this desert murmured with their toils,
Till twilight blushed, and lovers walked and wooed
In a forgotten language, and old tunes,
From instruments of unremembered form,
Gave the soft winds a voice.—BRYANT.

LESSON VIII.—CAVES AND GROTTOS OF THE OLD WORLD.

1. NATURAL caves, which are hollow places under ground, generally with openings on the surface, form a division of physical geography interesting alike to the man of science and the mere wonder-loving tourist. Nearly all the great caves in the world are in limestone rocks, and have been produced by the action of water, which, running in little streams through the strata and dissolving particles of rock,* has, in the course of ages, formed subterranean passages, often of great extent and wonderful beauty. Caves found in rocks of granite, lava, and porphyry, owe their origin to other causes.

2. It is not surprising that the priests of antiquity, for the purpose of producing an effect on the minds of the ignorant populace, localized their false divinities in caverns, which were so well calculated to awaken curiosity and excite the imagination. Thus the original Delphian oracles, revered by

* The water carries with it carbonic acid gas, by which limestone is rendered soluble.

the Greeks, and consulted by the monarchs of the ancient world, were delivered by a priestess seated at the mouth of a cave, who pretended to be inspired with a knowledge of future events. The primitive inhabitants of Northern Europe selected caves as appropriate places for their barbarous rites. Among these is the cave of Thor, "The Thunderer," in the limestone district of Derbyshire, England, described by Darwin as

"The blood-smeared mansion of gigantic Thor."

3. Of the celebrated caverns of the Eastern world, the most famous is that called "The Grotto of Antiparos,"¹ a magnificent stalactite² cavern in a little island of the same name in the Grecian Archipelago. Within its vaulted chambers are columns, some of which are twenty-five feet in length, hanging like icicles from the roof, while others extend from roof to floor. The following extract from the description given by Goldsmith, taken from the writings of an Italian traveler, will convey some idea of the scene presented in one of the interior chambers of this "enchanted grotto:"



The Grotto of Antiparos.

4. "Our candles being now all lighted up, and the whole place completely illuminated, never could the eye be presented with a more glitter-

ing or a more magnificent scene. The whole roof hung with solid icicles, transparent as glass, yet solid as marble. The eye could scarcely reach the lofty and noble ceiling; the sides were regularly formed with spars, and the whole presented the idea of a magnificent theatre illuminated with an immense profusion of lights. The floor consisted of solid marble; and in several places magnificent columns, thrones, altars, and other objects appeared, as if nature had designed to mock the curiosities of art. Our voices, upon speaking or singing, were redoubled to an astonishing loudness, and upon the firing of a gun, the noise and reverberations were almost deafening."

5. But perhaps the most remarkable of all the cavern-like



Fingal's Cave, in Staffa.

formations in Europe is that of Fingal's Cave, in Staffa, a small islet among the Hebrides. Almost all the rocks of the island are basaltic³ and columnar; but here they are so arranged as to present the appearance of a magnificent work of art. An opening from the sea, sixty-six feet high and forty-two feet wide, formed by perpendicular walls crowned by an arch, leads to a natural hall more than two hundred feet long, and bounded on each side by

perpendicular columns of great size, beautifully jointed, and arranged in varied groups. The roof is beautifully marked with the ends of pendent⁴ columns; and the whole is so well calculated to suggest the idea of a vast cathedral, as to have called forth the well-known lines of Sir Walter Scott on Fingal's Cave:

"When, as to shame the temples decked
By skill of earthly architect,
Nature herself, it seemed, would raise
A minster⁵ to her Maker's praise."

"The Cathedral of Iona," says a late writer, "sinks into insignificance before this great temple of nature, reared, as if in mockery of the temples of man, by the Almighty power who laid the beams of his chambers on the waters, and who walketh upon the wings of the wind."

¹ AN-TIP'-A-ROB, NOW AN-TIP'-A-RO.

² STA-LÄC'-TITE, a pendent cone of carbonate of lime in the form of an icicle.

³ BA-SALT'-IC; basalt is a grayish black stone.

of igneous origin, often in a columnar form.

⁴ PĒND'-ENT, hanging.

⁵ MĪN'-STER, a cathedral church.

LESSON IX.—CAVES IN THE UNITED STATES.



Hall of Statuary, in Weyer's Cave, Virginia.

in Kentucky.

2. Weyer's Cave, which is in a limestone region, has a length of sixteen hundred feet in a straight line, but the aggregate of its branches and windings is near three thousand. Its numerous and extensive apartments, which have received various names from their fancied resemblance to temples, palaces, halls, cathedrals, etc., and which abound in stalactites¹ of almost every possible variety of form and grouping, have been not inappropriately compared to the enchanted palaces of Eastern story. An engraving of the "Hall of Statuary," which we place at the head of this lesson, showing the stalagmites¹ rising from the floor, and the pendent stalactites¹ still dripping with lime-water, illustrates the process of these curious formations.

3. But the largest and most remarkable cave in the world is the famous Mammoth Cave in Kentucky, a region of vast and still unknown extent, hidden from the light of day. It has already been explored to the distance of ten miles, and a river navigable by boats affords a convenient means of pene-

1. SUBTERRANEAN caverns are not uncommon in our own country, and some of them will be found to rival in beauty, and greatly to surpass in extent, those of the Old World. We have space to enumerate but few of them here, but among the more noted may be mentioned the Big Salt-petre Cave in Marion County, Missouri, which, although yet but partially explored, promises to rival all others in beauty and extent; Weyer's Cave, in Augusta County, Virginia; and the celebrated Mammoth Cave

trating its subterranean recesses. Stalactites of immense size and fantastic forms adorn the interior, though they are less brilliant and beautiful than those of some other caverns.

4. Bats and rats are abundant in this cave, and several species of insects are found in its dark recesses. In its waters have been found two species of fish, in color nearly white, and unknown elsewhere. One of these is the eyeless fish; and the other, though with the appearance of eyes, is entirely blind, showing that where eyes are of no use, nature finally dispenses with them—a proceeding in perfect harmony with the physiological law that disuse of an organ gradually leads to its destruction.

5. A volume might be written descriptive of the wonders of this "Mammoth Cave"—of its mysterious chambers, its pillared domes, its echoing halls, its fathomless gulfs, and its dark waters; but in the brief space at our command we can not do better than submit the following from the pen of an American poet.

¹ STA-LÄG'-MÎTE, STA-LAC'-TÎTE, layers or deposits of carbonate of lime, the former rising from the floor, the latter hanging from the roof.

LESSON X.—THE MAMMOTH CAVE.

1. ALL day, as day is reckoned on the earth,
I've wandered in these dim and awful aisles,
Shut from the blue and breezy dome of heaven;
While thoughts, wild, drear, and shadowy, have swept
Across my awe-struck soul, like spectres o'er
The wizard's magic glass, or thunder-clouds
O'er the blue waters of the deep. And now
I'll sit me down upon yon broken rock,
To muse upon the strange and solemn things
Of this mysterious realm.
2. All day my steps
Have been amid the beautiful, the wild,
The gloomy, the terrific. Crystal fountains,
Almost invisible in their serene
And pure transparency—high pillar'd domes,
With stars and flowers all fretted¹ like the halls
Of Oriental monarchs—rivers, dark
And drear, and voiceless as oblivion's stream
That flows through Death's dim vale of silence—gulfs,
All fathomless, down which the loosened rock
Plunges, until its far-off echoes come
Fainter and fainter, like the dying roll
Of thunders in the distance—Stygian² pools,
Whose agitated waves give back a sound
Hollow and dismal, like the sullen roar

In the volcano's depths—these, *these* have left
Their spell upon me, and their memories
Have passed into my spirit, and are now
Blent with my being, till they seem a part
Of my own immortality.

3. God's hand,
At the creation, hollowed out this vast
Domain of darkness, where no herb nor flower
E'er sprang amid the sands; no dews nor rains,
Nor blessed sunbeams, fell with freshening power;
Nor gentle breeze its Eden-message told
Amid the dreadful gloom. Six thousand years
Swept o'er the earth ere human footprints marked
This subterranean desert. Centuries,
Like shadows, came and passed, and not a sound
Was in this realm, save when at intervals,
In the long lapse of ages, some huge mass
Of overhanging rock fell thundering down,
Its echoes sounding through these corridors³
A moment, and then dying in a hush
Of silence, such as brooded o'er the earth
When earth was chaos.
4. The great mastodon,⁴
The dreaded monster of the elder world,
Passed o'er this mighty cavern, and his tread
Bent the old forest oaks like fragile reeds,
And made earth tremble. Armies in their pride,
Perchance, have met above it in the shock
Of war, with shout, and groan, and clarion blast,
And the hoarse echoes of the thunder-gun.
The storm, the whirlwind, and the hurricane
Have roared above it, and the bursting cloud
Sent down its red and crashing thunder-bolt.
Earthquakes have trampled o'er it in their wrath,
Rocking earth's surface as the storm-wind rocks
The old Atlantic; yet no sound of these
E'er came down to the everlasting depths
Of these dark solitudes.
5. How oft we gaze
With awe or admiration on the new
And unfamiliar, but pass coldly by
The lovelier and the mightier! Wonderful
Is this lone world of darkness and of gloom,
But far more wonderful yon outer world,
Lit by the glorious sun. These arches swell
Sublime in lone and dim magnificence.
But how sublimer God's blue canopy
Beleaguered⁵ with his burning cherubim,⁶
Keeping their watch eternal!
6. Beautiful
Are all the thousand snow-white gems that lie
In these mysterious chambers, gleaming out

Amid the melancholy gloom; and wild
 These rocky hills, and cliffs, and gulfs; but far
 More beautiful and wild the things that greet
 The wanderer in our world of light—the stars
 Floating on high, like islands of the bless'd—
 The autumn sunsets, glowing like the gate
 Of far-off Paradise—the gorgeous clouds,
 On which the glories of the earth and sky
 Meet and commingle—earth's unnumbered flowers
 All turning up their gentle eyes to heaven—
 The birds, with bright wings glancing in the sun,
 Filling the air with rainbow miniatures—
 The green old forests, surging in the gale—
 The everlasting mountains, on whose peaks
 The setting sun burns like an altar flame—
 And ocean, like a pure heart, rendering back
 Heaven's perfect image, or in his wild wrath
 Heaving and tossing like the stormy breast
 Of a chained giant in his agony.—GEORGE D. PRENTICE.

¹ FRĒT'-TED, formed into raised work.

² STYĒ'-I-AN, dark; pertaining to the river Styx, a fabulous river of the lower world, which was to be crossed in passing to the regions of the dead.

³ CŒR'-EL-DŌRS, gallery-like passages.

⁴ MĀS'-TO-DON, an animal much like the elephant, now extinct. See p. 469.

⁵ BE-LEA'-GUERED, studded with; surrounded by, as by an army that *beleaguers* a city.

⁶ CHER'-Ū-MIM, the plural of cherub. Here meaning the *stars*. See Genesis, iii., 24.

LESSON XI.—AVALANCHES AND GLACIERS.

1. VAST masses of snow, which accumulate on the precipitous sides of mountains, being frequently disturbed from their positions, roll or slide down to lower levels.

Hark! the rushing snow!

The sun-awakened avalanche! whose mass,
 Thrice sifted by the storm, had gathered there
 Flake after flake; in heaven-defying minds
 As thought by thought is piled, till some great truth
 Is loosened, and the nations echo round,
 Shaken to their roots, as do the mountains now.—SHELLEY.

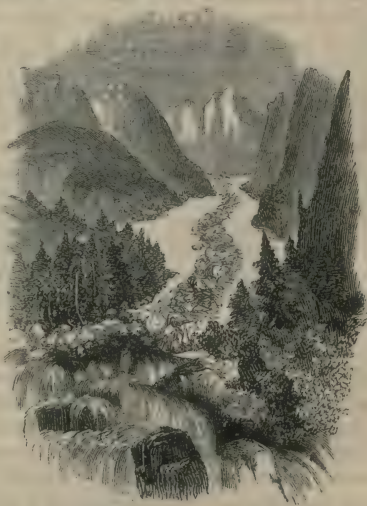
2. Immense masses of earth and rock, also, loosened by the rains or by the thawing of the frosts, are precipitated down the mountain steeps, sometimes sweeping before them whole forests, and overwhelming villages in the valleys beneath. Such rolling or sliding masses, whether of snow, or of earth and rocks, are called *avalanches*. Such, also, are mountain-slides, which are a constant terror to the inhabitants of the narrow Alpine valleys.

3. The name of *glaciers* is given to those immense masses of *ice* which accumulate on the peaks and slopes, but in the greatest quantities in the upper *valleys* of lofty mountains. Although those parts of the mountains which are above the line of congelation are covered with perpetual snow, yet this

snow, being partially thawed during the summer months, is, on the approach of winter, converted into ice, thus constituting what is called a glacier. Yet the glacier ice does not resemble that found in ponds and rivers; not being formed in layers, but consisting of small grains or crystals of congealed snow, it has neither the compactness, the solidity, nor the transparency of river ice.

4. The glacier ice, descending by a thousand channels along the slopes of the mountains into the valleys, accumulates there in vast beds or fields, presenting, where the descent of the valley is gradual, a very level surface, and with few crevices; but where there is a rapid or rugged declivity the surface is rent with numerous, and often deep and dangerous chasms, and covered with elevations of icy peaks which are sometimes one or two hundred feet high. These glaciers not unfrequently work their way gradually down into the lower valleys.

5. This is particularly the case in the valley of Chamouni, where the singular spectacle is presented of huge pyramids of ice of a thousand fantastic forms in juxtaposition with the most luxuriant pastures, or towering in majestic grandeur in the midst of verdant forests. "The snow-white masses," says Lyell, "are often relieved by a dark background of pines, as in the valley of Chamouni; and they are not only surrounded with abundance of the wild rhododendron in full bloom, but they encroach still lower into the region of cultivation, and trespass on fields where the tobacco-plant is flourishing by the side of the peasant's hut."



An Alpine Glacier.

6. The lower extremities of these glaciers are sometimes excavated by the melting of the ice into the form of immense grottoes, adorned with the finest stalactic crystallizations,

whose brilliant azure tints are reflected on the foaming streams and torrents which generally issue from these caverns, forming altogether so beautiful and imposing a picture as to defy the most faithful pencil to portray it accurately. These scenes are beautifully described by Coleridge in his

HYMN BEFORE SUNRISE IN THE VALLEY OF CHAMOUNI.

7. *a.* "Ye ice falls! ye that from the mountain's brow
 Adown enormous ravines slope amain—
 Torrents, methinks, that heard a mighty voice,
 And stopped at once amid their maddest plunge":
 a. Motionless torrents! silent cataracts!
 Who made you glorious as the gates of heaven
 Beneath the keen full moon? Who bade the sun
 Clothe you with rainbows? Who, with living flowers
 Of loveliest blue, spread garlands at your feet?
 God! let the torrents, like a shout of nations,
 b. Answer! and let the ice plains echo God!
 God! sing, ye meadow streams', with gladsome voice!
 Ye pine groves', with your soft and soul-like sounds!
 And they, too, have a voice, yon piles' of snow!
 b. And in their perilous fall shall thunder God!"

8. It is known that the great glacier beds of Switzerland move gradually and silently down the valleys at the rate of about twenty-five feet annually—a phenomenon which has long been an interesting subject of scientific investigation. "Philosophers and naturalists," says Brande, "have attributed the downward movement of a glacier to various causes; but by far the most prevalent opinion respecting it is that of Saussure, who maintained it was nothing more than a slipping upon itself, occasioned by its own weight. On the other hand, M. Agassiz ascribes this motion to the expansion of the ice, resulting from the congelation of the water which has filtered into it and penetrated its cavities; while M. R. Mallet is inclined to attribute it to the hydrostatic pressure of the water which flows at the bottom, and makes rents in the mass."

9. The inhabitants of the plains, reposing in almost uninterrupted security from that "war of the elements" which nature ever wages in more elevated regions, seldom realize the many dangers from avalanches of snow, and ice, and rocks, and mountain torrents, to which the "dwellers of the hills" are almost constantly exposed. To their reflections we commend the following picture, which has had many a counterpart in the Scottish Highlands, in the upper Swiss valleys, and in all mountain regions where man plants his dwelling. It is but a few years since that an entire family of nine per-

a. *a.* The direct address, when *exclamatory*, takes the falling inflection.
b. *b.* Good examples of the rhetorical pause of suspension. See page 22.

sons, residing in a cottage at the celebrated "Notch," a narrow defile of the White Mountains of New Hampshire, was destroyed by an avalanche of earth and water, not one being left to relate the events of that night of terrors. What gives to the event a peculiarly mournful interest, the house from which they had fled, doubtless on the first alarm, was left uninjured amid the surrounding desolation.

LESSON XII.—THE COTTAGE OF THE HILLS.

1. How sweetly 'neath the pale moonlight,
That slumbers on the woodland height,
Yon little cot appears, just seen
Amid the twining evergreen,
That fondly clings around its form.
Poor trembler, I have seen like thee,
Fond woman in her constancy,
E'en when the stormiest hour came on,
Cling closer to the much-loved one,
Nor dream, till every tie was parted,
That all within was hollow-hearted.
2. Yon little cot looks wondrous fair,
And yet no taper-light is there!
Say, whither are its dwellers gone?
Bird of the mountain, thou alone
Saw by the lightning from on high,
The *mountain-torrent* rushing by;
Beheld, upon its wild wave borne,
The tall pine from the hill-top torn.
Amid its roar, thine ear alone
Heard the shrill shriek—the dying groan—
The prayer that struggled to be free—
Breathed forth in life's last agony!
In vain—no angel form was there—
The wild wave drowned the sufferers' prayer
As down the rocky glen they sped—
The mountain spirits shriek'd and fled!
3. 'Twas morning; and the glorious sun
Shone on the work which death had done—
On shattered cliff, and broken branch,
The ruin of the avalanche!
And there lay *one*, upon whose brow
Age had not shed its wintry snow;
The fragment in whose clenched hand told
How firm on life had been his hold,
While the curled lip, the upturned eye,
Told of a *father's agony*!
And there beside the torrent's path,
Too pure, too sacred for its wrath,

Lay *one*, whose arms still closely pressed
 An *infant* to her frozen breast.
 The kiss, upon its pale cheek sealed,
 A *mother's quenchless love* revealed.

4. Sire, mother, offspring—all were there,
 Not one had 'scaped the conqueror's snare,
 Not one was left to weep alone;
 The "*dwellers of the hill*" were gone!
 The wild bird, soaring far on high,
 Beheld them with averted eye;
 The forest prowler, as he pass'd,
 Looked down upon the rich repast,
 But dared not banquet. 'Twas a spell
 Which bound them in that lonely dell;
 And there they slept so peacefully,
 That the lone pilgrim, passing by,
 Had deemed them of a brighter sphere,
 Condemned a while to linger here,
 Whose pure eyes, sickening at the sight
 Of sin and sorrow's withering blight,
 Had sought, in tears, that silent glen,
 And slumbered—ne'er to wake again.
5. And there they found them; stranger hands
 Bore them to where yon cottage stands,
 And there, one summer evening's close,
 They left them to their last repose.
 Such the brief page thy story fills,
 Thou lonely "*cottage of the hills*."
 E'en while I gaze, night's gloomy shade
 Is gathering, as the moonbeams fade.
 Around thy walk they faintly play—
 They tremble—gleam—then flit away;
 They fade—they vanish down the dell:
 Lone "*cottage of the hills*"—farewell!—*Anonymous.*

LESSON XIII.—VOLCANOES AND EARTHQUAKES.



Volcano of Vesuvius.

1. OPENINGS in the crust of the earth, usually through mountains, from which issue smoke, flame, or gases so illuminated as to appear like flame, and streams of melted rock called lava, are known by the name of volcanic craters. The "burning mountains" themselves are usually called *volcanoes*. An *earthquake*, or "shaking of the earth," is probably produced by fractures and sudden heavings and sinkings

in the elastic crust of the globe, caused by the pressure of the liquid fire, vapor, and gases in its interior. Volcanoes are the chimneys of these internal fires, and when they get vent the earthquake always ceases.

2. It appears, from numerous observations, that the internal heat of the earth gradually increases as we descend below the surface, so that, at the depth of two hundred miles, the hardest substances must be in a state of fusion; but whether our globe is encompassed by a mere stratum of melted lava at that depth, or its whole interior is a ball of liquid fire, seventy-six hundred miles in diameter, inclosed in a thin coating of solid matter, men of science are not agreed.

3. Some portions of the earth are much more subject to volcanoes and earthquakes than others. The range of the Andes, from Cape Horn to California, with a cross section embracing the Caribbean Sea, and extending westward quite across the Pacific Ocean, is one vast district of igneous action. A great volcanic chain, beginning at the northeastern extremity of Asia, follows the coast-line around Asia and Africa, and thence up to the Canaries and the Azores, while a broad belt extends over the Mediterranean and a large part of Central Asia. Northwardly the volcanic fires are developed in Iceland with tremendous force; and the recently discovered antarctic land is an igneous formation of the boldest structure, whence a volcano in high activity rises twelve thousand feet above the perpetual ice of those polar deserts, and within nineteen and a half degrees of the south pole. On an average, twenty volcanic eruptions take place annually in different parts of the world.

4. Volumes might be filled with accounts of the destructive effects of earthquakes and volcanoes. Whole cities, of which Herculaneum, Pompeii, and Stabiae are examples, have been buried beneath the burning fire of liquid mountains. But where one city has been destroyed by lava, twenty have been shaken down by the rocking and heaving of earthquakes. Prominent on the list of the latter is the city of Antioch, in Asia Minor.

5. "Imagine," says Dr. Hitchcock, "the inhabitants of that great city, crowded with strangers on a festival occasion, suddenly arrested on a calm day by the earth heaving and rocking beneath their feet; and in a few moments two hundred and fifty thousand of them are buried by falling houses, or the earth opening and swallowing them up. Such was the scene which that city presented in the year 526; and several times before and since that period has the like calamity fallen upon it, and twenty, forty, and sixty thousand of its inhabitants have been destroyed at each time. In the year

17 after Christ, no less than thirteen cities of Asia Minor were in like manner overwhelmed in a single night.

6. "Think of the terrible destruction that came upon Lisbon in 1755. The sun had just dissipated the fog in a warm, calm morning, when suddenly the subterranean thundering and heaving began; and in six minutes the city was a heap of ruins, and sixty thousand of the inhabitants were numbered among the dead. Hundreds had crowded upon a new quay surrounded by vessels. In a moment the earth opened beneath them, and the wharf, the vessels, and the crowd went down into its bosom; the gulf closed, the sea rolled over the spot, and no vestige of wharf, vessels, or man ever floated to the surface."

7. One of the most singular effects produced, either by earthquakes or by the gradual pressure of the internal fires and gases, is the occasional raising of the earth's crust to a great extent. In South America, so late as the year 1822, an area of one hundred thousand square miles was raised several feet above its present level. In 1819 a strip in the delta of the Indus, fifty miles in length and less than twenty feet in width, was raised ten feet above the surrounding plain. Along the eastern coast of the Bay of Bengal, all the rocks and islands for a distance of one hundred miles have been gradually rising during the last hundred years, and in the central portion the elevation already attained is twenty-two feet.

8. Occasionally volcanic islands suddenly appear above the surface of the ocean; and when this is the case, or when an earthquake has its origin beneath the ocean's bed, an immense wave is sometimes driven upon the shore, overwhelming the inhabitants, and bearing their bodies to the ocean in its retreat. The earthquake which destroyed Lisbon in 1755 had its origin in the bed of the Atlantic, whence the shock extended over an area of about seven hundred thousand square miles, or a twelfth part of the circumference of the globe.

9. It was by an enormous wave, occasioned by an earthquake that had its origin in the bed of the Mediterranean, that the little maritime town of Scylla, on the coast of Naples, was destroyed in 1783. The waters passed with impetuosity over the shore of Scylla, and, in their retreat to the bosom of the deep, swept away four thousand human beings who had thought to find safety in the barrenness of the sands. This catastrophe is vividly portrayed in the following lines:

DESTRUCTION OF SCYLLA IN 1783.

10.

Calmly the night came down
O'er Scylla's shutter'd walls;
How desolate that silent town!
How tenantless the halls

- Where yesterday her thousands trode,
And princes graced their proud abode !
11. Low, on the wet sea-sand,
Humbled in anguish now,
The despot,* midst his menial band,
Bent down his kingly brow—
Ay, prince and peasant knelt in prayer,
For grief had made them equal there.
12. Again !—as at the morn,
The earthquake rolled its car ;
Lowly the castle-towers were borne,
That mock'd the storms of war.
The mountain reel'd—its shiver'd brow
Went down among the waves below.
13. Up rose the kneelers then,
As the wave's rush was heard :
The silence of those fated men
Was broken by no word.
But closer still the mother press'd
The infant to her faithful breast.
14. One long, wild shriek went up,
Full mighty in despair ;
As bow'd to drink death's bitter cup
The thousands gather'd there ;
And man's strong wail, and woman's cry,
Blent as the waters hurried by.
15. On swept the whelming sea ;
The mountains felt its shock,
As the long cry of agony
Thrill'd through their towers of rock ;
And echo round that fatal shore
The death-wail of the sufferers bore.
16. The morning sun shed forth
Its light upon the scene,
Where tower and palace strewed the earth
With wrecks of what had been ;
But of the thousands who were gone,
No trace was left—no vestige shown.—*Anonymous.*

LESSON XIV.—THE OCEAN : ITS MORAL GRANDEUR.

“THE sea ! the sea ! the open sea !
The blue, the fresh, the ever free !
Without a mark, without a bound,
It runneth the earth's wide regions round ;
It plays with the clouds, it mocks the skies,
Or like a cradled creature lies.”

1. There are two widely different aspects in which the ocean may be viewed. It may be regarded as an object of moral grandeur—“the symbol of a drear Immensity”—a Voice that sometimes “speaketh in thunders” to awe the world ; a Power, terrible in its wrath, but lovely in repose ; or it may be viewed as the great highway of commerce, and as a vast store-house of wealth : the laws which govern its tides, its waves, and its currents may be presented as objects of scientific regard, and the mysteries of its depths as

* The Prince of Scylla perished with his vassals.

opening some of the most interesting departments in natural history. But it is only when we unite, in our contemplation, these various aspects, that we begin to have any adequate idea of the real interest and importance of this, the grandest division of our globe.

2. The first impression made by a view of the ocean is doubtless that of vastness, illimitable—inappreciable; while the thoughts which its mighty waters teach are those of “Eternity, Eternity, and Power.” Such thoughts are forcibly expressed in the following lines addressed to

THE OCEAN.

3. Oh thou vast ocean ! ever sounding sea !
 Thou symbol of a drear immensity !
 Thou thing that windest round the solid world
 Like a huge animal, which, downward hurled
 From the black clouds, lies weltering and alone,
 Lashing and writhing till its strength be gone !
 Thy voice is like the thunder, and thy sleep
 Is as a giant's slumber, loud and deep.
 Thou speakest in the east and in the west
 At once, and on thy heavily-laden breast
 Fleets come and go, and things that have no life
 Or motion, yet are moved and met in strife.
4. The earth hath naught of this : no chance nor change
 Ruffles its surface, and no spirits dare
 Give answer to the tempest-wakened air ;
 But o'er its wastes the weakly tenants range
 At will, and wound its bosom as they go :
 Ever the same, it hath no ebb, no flow ;
 But in their stated rounds the seasons come,
 And pass like visions to their viewless home,
 And come again, and vanish : the young Spring
 Looks ever bright with leaves and blossoming ;
 And Winter always winds his sullen horn,
 When the wild Autumn, with a look forlorn,
 Dies in his stormy manhood ; and the skies
 Weep, and flowers sicken, when the Summer flies.
5. Thou only, terrible ocean, hast a power,
 A will, a voice, and in thy wrathful hour,
 When thou dost lift thine anger to the clouds,
 A fearful and magnificent beauty shrouds
 Thy broad green forehead. If thy waves be driven
 Backward and forward by the shifting wind,
 How quickly dost thou thy great strength unbind,
 And stretch thine arms, and war at once with Heaven !
6. Thou trackless and immeasurable main !
 On thee no record ever lived again
 To meet the hand that writ it : line nor lead
 Hath ever fathomed thy profoundest deeps,
 Where haply the huge monster swells and sleeps,
 King of his watery limit, who, 'tis said,
 Can move the mighty ocean into storm—
 Oh, wonderful thou art, great element,
 And fearful in thy spleeny humors bent,
 And lovely in repose ; thy summer form
 Is beautiful, and when thy silver waves
 Make music in earth's dark and winding caves,
 I love to wander on thy pebbled beach,
 Marking the sunlight at the evening hour,
 And hearken to the thoughts thy waters teach—
 “Eternity, Eternity, and Power.”—BRYAN W. PROCTOR.

LESSON XV.—THE OCEAN: ITS PHYSICAL ASPECTS.

1. THE bed of the ocean, like dry land, is diversified by plains and mountains, table-lands and valleys, sometimes barren, sometimes covered with marine vegetation, and teeming with life. Its plateaus and depressions have been ascertained by the sounding-line, and are mapped out in profile as a part of our geographical knowledge. Its average depth is believed to be about equal to the height of the land, the lowest valleys of the ocean's bed corresponding with the summits of the loftiest mountains.

2. The ocean is continually receiving the spoils of the land, washed down by numerous rivers, and deposited as sand and mud, or held in solution in its waters. These causes tend to diminish its depth and increase its superficial extent. There are, however, causes in operation which counteract these agencies. It is clearly shown by geologists that processes of elevation and subsidence are continually taking place in different parts of the globe.

3. The waters of the ocean contain about three and a half per cent. of saline matter; but, owing to the melting of snow and ice in the polar regions, and the volumes of fresh water poured in by rivers, the degree of saltiness diminishes toward the poles, and also near the shores. The temperature of the ocean, though varying in different latitudes, is more uniform than that of the land; its color, generally of a deep bluish-green, is varied in particular localities by the myriads of animalcules and vegetable substances which float on its surface, and also, in shallow places, by the color of the bed on which it rests. In some parts of the tropical seas the waters are remarkably clear, like an immense vase of crystal; and one may look downward unmeasured fathoms beneath the vessel's keel, but still find no boundary: the sight is lost in one uniform transparent blueness. The calm "midnight ocean" of the tropics has been beautifully described in the following lines:

4.

It is the midnight hour—the beauteous sea,
 Calm as the cloudless heaven, the heaven discloses,
 While many a sparkling star, in quiet glee,
 Far down within the watery sky reposes.
 As if the ocean's heart were stirr'd
 With inward life, a sound is heard,
 Like that of dreamer murmuring in his sleep;
 'Tis partly the billow, and partly the air
 That lies like a garment floating fair
 Above the happy deep.—JOHN WILSON.

LESSON XVI.—SHIP AMONG THE ICEBERGS.

1. A FEARLESS shape of brave device,
Our vessel drives through mist and rain
Between the floating ships of ice,
Those navies of the northern main;
Those arctic ventures blindly hurled,
The proofs of Nature's olden force,
Like fragments of a crystal world
Long shattered from its skiey course.
2. These are the hurricanes that fright
The middle sea with dream of wrecks,
And freeze the south winds in their flight,
And chain the Gulf Stream to their decks.
At every dragon prow and helm
There stands some viking as of yore,
Grim heroes from the boreal realm,
Where Odin rules the spectral shore.
3. Up signal there! and let us hail
Yon looming phantom as we pass;
Note all her fashion, hull and sail,
Within the compass of your glass.
See at her mast the steadfast glow
Of that one star of Odin's throne;
Up with our flag, and let us show
The constellation on our own.
And speak her well; for she might say,
If from her heart the words could thaw,
Great news from some far frozen bay,
Or the remotest Esquimaux.
4. No answer: but the sullen flow
Of ocean heaving long and vast;
An argosy of ice and snow,
The voiceless North swings proudly past.

LESSON XVII.—THE DEPTHS OF OCEAN.

DRUMMOND.

1. NOTHING can be more beautiful than a view of the bottom of the ocean during a calm, even round our own shores, but particularly in *tropical* climates, especially when it consists alternately of beds of sand and masses of rock. The water is frequently so clear and undisturbed that, at great depths, the minutest objects are visible; groves of coral are seen expanding their variously-colored clumps, some rigid and immovable, and others waving gracefully their flexile branches. Shells of every form and hue glide

slowly along the stones, or cling to the coral boughs like fruit; crabs and other marine animals pursue their prey in the crannies of the rocks, and sea-plants spread their limber leaves in gay and gaudy irregularity, while the most beautiful fishes are on every side sporting around.

2. The floor is of sand, like the mountain-drift,
 And the pearl-shells spangle the flinty snow;
 From coral rocks the sea-plants lift
 Their boughs, where the tides and billows flow;
 The water is calm and still below,
 For the winds and waves are absent there;
 And the sands are bright as the stars that glow
 In the motionless fields of the upper air.
3. There, with its waving blade of green,
 The sea-flag streams through the silent water,
 And the crimson leaf of the dulse is seen
 To blush like a banner bathed in slaughter;
 There, with a light and easy motion,
 The fan-coral sweeps through the clear deep sea,
 And the yellow and scarlet tufts of ocean
 Are bending like corn on the upland lea;
 And life in rare and beautiful forms
 Is sporting amid those bowers of stone,
 And is safe when the wrathful spirit of storms
 Has made the top of the waves his own.
4. And when the ship from his fury flies
 Where the myriad voices of ocean roar,
 When the wind-god frowns in the murky skies,
 And demons are waiting the wreck on shore,
 Then far below in the peaceful sea
 The purple mullet and gold-fish rove,
 Where the waters murmur tranquilly
 Through the bending twigs of the coral grove.—PERCIVAL.

5. The allusion to the “peaceful sea,” below the reach of the storms which agitate the surface, has reference to the well-known fact that the effects of the strongest gale do not extend below the depth of two hundred feet: were it not so, the water would be turbid, and shell-fish would be destroyed.

LESSON XVIII.—OCEAN WAVES.

1. ROLL on, thou deep and dark blue ocean—roll!
 Ten thousand fleets sweep over thee in vain;
 Man marks the earth with ruin—his control
 Stops with the shore; upon the watery plain
 The wrecks are all thy deed, nor doth remain
 A shadow of man's ravage, save his own,
 When, for a moment, like a drop of rain,
 He sinks into thy depths with bubbling groan,
 Without a grave, unknelled, unconfined, and unknown.
2. And I have loved thee, ocean! and my joy
 Of youthful sports was on thy breast to be
 Borne, like thy bubbles, onward: from a boy
 I wanted with thy breakers—they to me
 Were a delight; and if the freshening sea
 Made them a terror, 'twas a pleasing fear,
 For I was, as it were, a child of thee,
 And trusted to thy billows far and near,
 And laid my hand upon thy mane—as I do here.—BYRON.

3. The three great movements of the ocean are *waves*, caused by the winds, *tides*, caused by the attraction of the sun and moon, and *currents*, caused by the earth's rotatory motion and the unequal heating of the waters.

4. There is a kind of wave or undulation called a *ground swell*, occasioned by the long continuance of a heavy gale. This undulation is rapidly transmitted through the ocean to places far beyond the direct influence of the gale that caused it, and often it continues to heave the smooth and glassy surface of the sea long after the wind and surface waves have subsided.

5. The force of waves in severe gales is tremendous. Mr. Stephenson has estimated the force of waves which were twenty feet high as being *three tons* to each square foot against perpendicular masonry. Waves vary in magnitude, from a mere ripple to enormous billows, but their height in storms is from ten to twenty-two feet. From the bottom of the hollow, or "trough of the sea," the height will be double that of the wave, or from twenty to forty-four feet. The distance between one "storm wave" and another is about five hundred and sixty feet, and the velocity of the waves about thirty-two miles an hour.

* 6. There is no more magnificent sight than the roll of the breakers as they dash upon some rock-bound coast. The "roar of the surf" after a storm is often tremendous, and may be heard at the distance of many miles. The spray is sometimes thrown as high as one hundred and fifty feet; and light-houses more than a hundred feet in height are often literally buried in foam and spray, even in those ground swells where there is no wind.

7. But when an ocean wave has exhausted its force, and breaks in a gentle ripple on the shore, nothing can be more peacefully beautiful, and no music falls with sweeter cadence on the ear. How different the picture from Byron, which we have placed at the head of this lesson, from the one with which we close!

TO A DYING WAVE.

8. List! thou child of wind and sea,
 Tell me of the far-off deep,
 Where the tempest's wind is free,
 And the waters never sleep!
 Thou perchance the storm hast aided,
 In its work of stern despair,
 Or perchance thy hand hath braided,
 In deep caves, the mermaid's hair.
9. Wave! now on the golden sands,
 Silent as thou art, and broken,

- Bear'st thou not from distant strands
To my heart some pleasant token' ?
Tales of mountains of the south,
Spangles of the ore of silver,
Which with playful singing mouth,
Thou hast leaped on high to pilfer' ?
10. Mournful wave ! I deemed thy song
Was telling of a mournful prison,
Which, when tempests swept along,
And the mighty winds were risen,
Foundered in the ocean's grasp,
While the brave and fair were dying.
Wave ! didst mark a white hand clasp
In thy folds as thou wert flying ?
11. Hast thou seen the hallowed rock
Where the pride of kings reposes,
Crowned with many a misty lock,
Wreathed with sapphire green and roses ?
Or with joyous playful leap,
Hast thou been a tribute flinging,
Up that bold and jutting steep,
Pearls upon the south wind stringing ?
12. Faded wave ! a joy to thee,
Now thy flight and toil are over !
Oh may my departure be
Calm as thine, thou ocean rover !
When this soul's last joy or mirth
On the shore of time is driven,
Be its lot like thine on earth,
To be lost away in heaven !—*Anonymous.*

LESSON XIX.—TIDES AND CURRENTS.

1. THE alternate elevation and depression of the waters of the ocean twice every twenty-four hours, was formerly considered one of the greatest mysteries of nature. The first man who clearly explained the cause and phenomena of tides was Sir Isaac Newton. Their true cause he demonstrated to be the attraction of the sun and moon, particularly the latter on account of her proximity to the earth.

2. The average height of the tides will be increased by a very small amount for ages to come, on account of the decrease of the mean distance of the moon from the earth ; but after they have reached their greatest height, a reverse movement will take place. Thus there are great *tides of tides*, or oscillations between fixed limits, requiring immense periods of time for their accomplishment. The tidal wave extends to the very bottom of the ocean, and moves with great velocity.

3. "*Currents* of various extent, magnitude, and velocity," says Mrs. Somerville, "disturb the tranquillity of the ocean ; some of them depend upon circumstances permanent as the globe itself, others on ever-varying causes. Constant currents are produced by the combined action of the rotation of the earth, the heat of the sun, and the trade-winds ; periodical currents are occasioned by tides, monsoons, and other long-continued

winds; temporary currents arise from the tides, melting ice, and from every gale of some duration. A perpetual circulation is kept up in the waters of the main by these vast marine streams; they are sometimes superficial and sometimes submarine, according as their density is greater or less than that of the surrounding sea."

4. The most constant and most important of all these currents, and one which exerts a modifying influence on all the others, is that produced by the rotation of the earth on its axis. As the waters descend from the poles, where they have no rotatory motion, the earth's surface revolves more and more rapidly, until, at the equator, it has acquired an easterly motion of a thousand miles an hour; and as the waters do not fully partake of this motion, they are left behind, and consequently seem to flow westward in a vast stream nearly four thousand miles broad. This stream, being broken, and its parts changed in various directions by the islands and continents which it meets in its course, gives rise to numerous smaller currents, which in their turn are again modified by the general westerly flow, and by winds, rivers, and melting ice.

5. Among these smaller currents is the "Gulf Stream," occasioned chiefly by the constant flow of the waters of the tropics westward across the Atlantic Ocean. A part of this vast heated current is directed into the Gulf of Mexico; issuing thence, it proceeds in a northeasterly direction along the coast of the United States, and being deflected still farther eastward by the great island of Newfoundland, it crosses the Atlantic, and spreads its warm waters around the coasts of the British Isles. "It is the influence of this stream upon climates," says Lieutenant Maury, "that makes Erin the Emerald Isle, and clothes the shores of Albion with evergreen robes; while, in the same latitude on the other side, the shores of Labrador are fast bound in fetters of ice." Any convulsion of the globe that should open a broad channel through the isthmus of Panama would direct this stream into the Pacific, and change the British Isles into a scene of sterility and desolation.

6. It is very important for navigators to study the course and velocity of the ocean currents, as the length and safety of the voyage depend upon them. So much does this circulation of the ocean resemble the circulation of fluids in the human system, that our distinguished countryman, Captain Maury, who has so successfully studied and described them, has been appropriately called the "Harvey of the seas."

LESSON XX.—LAKES.



1. THE depressions on the surface of the earth, caused by earthquakes, volcanoes, or other means, are frequently filled with water, and constitute what are termed lakes. Rivers meeting with obstructions of hills and rocky ridges often form a lake, or chains of lakes, which serve the purposes of navigation, and give variety to the inland landscape.

2. Many lakes are fed by springs, and sometimes they are the sources of large rivers. It is estimated that more than half the fresh water on the globe is contained in the great American lakes, the largest of which is nearly as large in area as England. Lakes are most numerous in high latitudes, where there is abundant rain and but little evaporation.

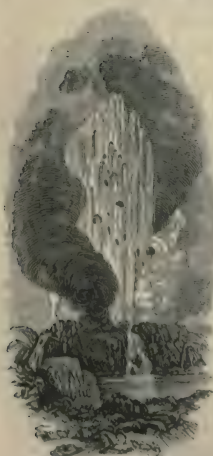
3. The five great American lakes, Superior, Huron, Erie, Michigan, and Ontario, are much higher than the level of the ocean. Lake Superior has an elevation of more than six hundred feet, and Lake Ontario two hundred and thirty-four feet. The Great Salt Lake, situated in the elevated table-land east of the Rocky Mountains, is about forty-two hundred feet above the level of the sea. Yet it is a curious fact that those great salt-water lakes of Asia, the Caspian Sea, Lake of Tiberias, and the Dead Sea, are each below the sea-

level, the first eighty-four feet, the second six hundred feet, and the third more than thirteen hundred feet. The poet Percival, in the following ode, has painted the witching charms of hundreds of our small interior lakes :

TO SENECA LAKE.

4. "On thy fair bosom, silver lake,
The wild swan spreads his snowy sail,
And round his breast the ripples break,
As down he bears before the gale.
5. On thy fair bosom, waveless stream,
The dipping paddle echoes far,
And flashes in the moonlight gleam,
And bright reflects the polar star.
6. The waves along thy pebbly shore,
As blows the north wind, heave their foam,
And curl around the dashing oar,
As late the boatman hies him home.
7. How sweet, at set of sun, to view
Thy golden mirror spreading wide,
And see the mist of mantling blue
Float round the distant mountain's side.
8. At midnight hour, as shines the moon,
A sheet of silver spreads below,
And swift she cuts, at highest noon,
Light clouds, like wreaths of purest snow.
9. On thy fair bosom, silver lake,
Oh ! I could ever sweep the oar,
When early birds at morning wake,
And evening tells us toil is o'er."

LESSON XXI.—SPRINGS AND RIVERS.



Great Geyser of Iceland.

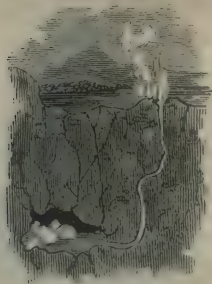
1. In addition to the common springs, with whose origin every one is familiar, mineral springs of great variety abound in different countries, the waters of some of which merely present a sparkling appearance, owing to the presence of carbonic acid gas, while others are variously impregnated with mineral substances, the chief of which are iron, sulphur, and salt.

2. Besides these, Iceland presents us a remarkable group of hot springs, called *geysers*, which burst forth with subterranean noises, and frequently at regular intervals, throwing up water and steam, sometimes to the height of one or two hundred feet. The supposed cause of this peculiar action is the heating of some internal fountain of water

by volcanic agency, until a sufficient quantity of steam is formed forcibly to expel the wa-

ter through a channel which has its opening in the spring.

An illustration of an *intermitting* spring is also given, for the action of which it is sufficient to refer to the principle of the siphon.*



Section of a Geyser.



Intermitting Spring.

3. The excess of water precipitated as rain and snow, over what is evaporated from the surface, runs in streams, called rivers, to lakes, or to the ocean. The position of mountains and elevated ridges determines the course and length of rivers. Few physical causes have had more influence in the location and fortunes of men, than rivers. Capitals of states and countries are generally on rivers, and large cities either on navigable rivers or bays.

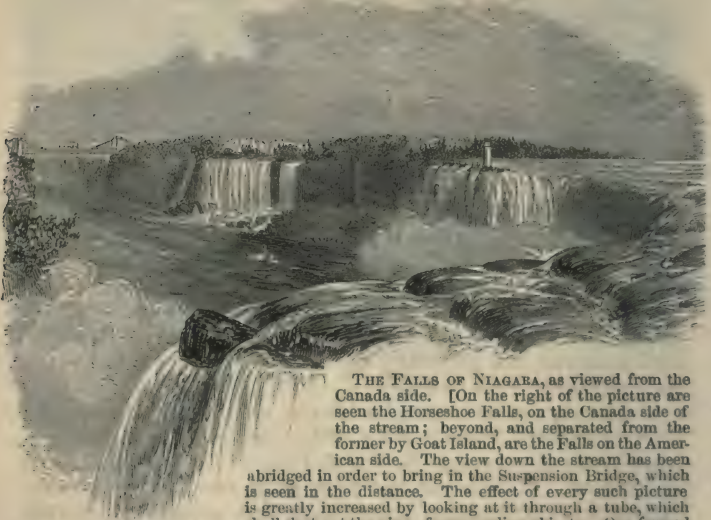
4. Rivers are associated with the earliest efforts of mankind to emerge from a state of barbarism; but they are no less serviceable to nations which have reached the acme of civilization. In the earliest ages they were regarded with veneration, and became the objects of a grateful adoration, surpassed only by that paid to the sun and the host of heaven.

5. Nor is this suprising; for in countries where the labors of the husbandman and shepherd depended, for a successful issue, on the falling of periodical rains, or the melting of the collected snows in a far-distant country, such rivers as the Nile, the Ganges, and the Indus were the visible agents of nature in bestowing on the inhabitants of their banks all the blessings of a rich and spontaneous fertility; and hence their waters were held sacred, and they received, and to this day retain, the adoration of the countries through which they flow.

* See p. 347. *Intermitting* springs sometimes flow only during the *dry* season. The cut above will explain this. Suppose the internal fountain to be empty. When the earth has become fully saturated with water during the wet season, the water begins to penetrate to the fountain, which gets filled as high as the upper bend of the siphon about the time when the dry season commences, and it is just then that the siphon *begins* to empty it; and it is evident that it will continue to act until the fountain is exhausted. After stopping, the water can not flow again until the fountain has been again filled, which probably will not be until near the end of the wet season.

6. The direction and extent of slopes of land give rise to a classification of rivers called *river systems*, which can be studied at length in works on physical geography.

LESSON XXII.—CATARACTS.



THE FALLS OF NIAGARA, as viewed from the Canada side. [On the right of the picture are seen the Horseshoe Falls, on the Canada side of the stream; beyond, and separated from the former by Goat Island, are the Falls on the American side. The view down the stream has been

abridged in order to bring in the Suspension Bridge, which is seen in the distance. The effect of every such picture is greatly increased by looking at it through a tube, which shall shut out the view of surrounding objects. One formed by partially closing the hand will answer.]

1. SOMETIMES large rivers fall suddenly over perpendicular rocks, forming cataracts, or *falls*. When a brook or small stream presents a similar phenomenon, it is usually called a *cascade*.

2. In mountain regions there are cascades hundreds of feet in height—so high that, from the resistance of the air, the water reaches the bottom as a fine spray. In southern Asia are several cascades more than eight hundred feet high: the Fall of Staubach, in Switzerland, described in Byron's "Manfred," has a perpendicular descent of eight hundred feet; and the Falls of the Rhine, though not so lofty as many others, are highly celebrated for their beauty.

3. Among American waterfalls, the most noted are those of the Montmorency, near Quebec, which descend two hundred and forty feet in an unbroken sheet; the Great and the

Little Falls of the Potomac, in Maryland; the Falls of the Missouri; the Rapids of the St. Lawrence, five hundred miles from its source; and, lastly, the grandest of all, and the mightiest in its mass of waters, the world-renowned Falls of Niagara. From a thousand descriptions of this great natural curiosity, our space limits us to a brief selection.

4. "There is a power and beauty, we may say a divinity, in rushing waters, felt by all who acknowledge any sympathy with nature. The mountain stream, leaping from rock to rock, and winding, foaming, and glancing through its devious and stony channels, arrests the eye of the most careless or business-bound traveler, sings to the heart, and haunts the memory of the man of taste and imagination, and holds, as by some indefinable spell, the affections of those who inhabit its borders. A waterfall of even a few feet in height will enliven the dullest scenery, and lend a charm to the loveliest; while a high and headlong cataract has always been ranked among the sublimest objects to be found in the compass of the globe.

5. "It is no matter of surprise, therefore, that lovers of nature perform journeys of homage to that sovereign of cataracts, that monarch of all pouring floods, the Falls of Niagara. It is no matter of surprise that, although situated in what might have been called a few years ago, but can not be now, the wilds of North America, five hundred miles from the Atlantic coast, travelers from all civilized parts of the world have encountered all the difficulties and fatigues of the path to behold this prince of waterfalls amid its ancient solitudes, and that, more recently, the broad highways to its dominions have been thronged. By universal consent, it has long ago been proclaimed one of the wonders of the world. It is alone in its kind. Though a waterfall, it is not to be compared with other waterfalls. In its majesty, its supremacy, and its influence on the soul of man, its brotherhood is with the living ocean and the eternal hills."—GREENWOOD.

6. From the vicinity of the famed Table Rock on the Canada side, the whole scene is presented in its highest degree of grandeur and beauty. On the right, and within a few feet, is the edge of the grand crescent, called the British, or Horseshoe Fall, which is more than one third of a mile broad, and one hundred and fifty-three feet in height. Opposite is Goat Island, which divides the falls; and lower down, to the left, is the American Fall, six hundred feet in breadth, and one hundred and sixty-four feet in height. From a writer who first viewed the falls from the vicinity of Table Rock, we take the following description:

7. "A mingled rushing and thundering filled my ears. I could see nothing, except when the wind made a chasm in the spray, and then tremendous cataracts seemed to encompass me on every side; while below, a raging and foamy gulf of undiscoverable extent lashed the rocks with its hissing waves, and swallowed, under a horrible obscurity, the smoking floods that were precipitated into its bosom.

8. "At first the sky was obscured by clouds, but, after a few minutes, the sun burst forth, and the breeze subsiding at the same time, permitted the spray to ascend perpendicularly. A host of pyramidal clouds rose majes-

tically, one after another, from the abyss at the bottom of the fall; and each, when it had ascended a little above the edge of the cataract, displayed a beautiful rainbow, which in a few moments was gradually transferred into the bosom of the clouds that immediately succeeded.

9. "The spray of the Great Fall had extended itself through a wide space directly over me, and, receiving the full influence of the sun, exhibited a luminous and magnificent rainbow, which continued to overarch and irradiate the spot on which I stood, while I enthusiastically contemplated the indescribable scene.

10. "The body of water which composes the middle part of the Great Fall is so immense that it descends nearly two thirds of the space without being ruffled or broken; and the solemn calmness with which it rolls over the edge of the precipice is finely contrasted with the perturbed appearance it assumes after having reached the gulf below. But the water toward each side of the fall is shattered the moment it drops over the rock, and loses, as it descends, in a great measure, the character of a fluid, being divided into pyramidal-shaped fragments, the bases of which are turned upward.

11. "The surface of the gulf below the cataract presents a very singular aspect, seeming, as it were, filled with an immense quantity of hoar-frost, which is agitated by small and rapid undulations. The particles of water are dazzlingly white, and do not apparently unite together, as might be supposed, but seem to continue for a time in a state of distinct comminution, and to repel each other with a thrilling and shivering motion, which can not easily be described."—HOWISON.

12. By descending a circular staircase, seventy or eighty feet in perpendicular height, a person may pass, by a narrow and slippery path, behind the Great Fall on the Canada side; but here he is frightfully stunned by the roar of the cataract; clouds of spray sometimes envelop, and almost suffocate him, and it is only a person of the strongest nerves that can proceed to the bottom of the fall; and there, it is said, only one emotion is experienced by every adventurer—that of uncontrollable terror.

13. Most descriptions of the falls are those of persons who have viewed them only in fine weather, when the contrast is most marked between their stern and awful grandeur, and the beauty of the surrounding landscape. But it seems that their grandeur is enhanced, if possible, by being viewed during a thunder-storm.

14. "Presently," remarks the writer from whom we first quoted, "a thunder-storm rose up from the west, and passed directly over us; and soon another came, still heavier than the preceding. And now I was more impressed than ever with the peculiar motion of the fall, not, however, because it experienced a change, but because it did not. The lightning gleamed, the thunder pealed, the rain fell in torrents; the storms were grand; but the fall, if I may give its expression

a language, did not heed them at all! the rapids poured on with the same quiet solemnity, with the same equable intentness, undisturbed by the lightning and rain, and listening not to the loud thunder."

LESSON XXIII.—A VISION'S SPELL—NIAGARA.

1. I stood within a vision's spell;
 I saw, I heard. The liquid thunder
 Went pouring to its foaming hell,
 And it fell,
 Ever, ever fell
 Into the invisible abyss that opened under.
2. I stood upon a speck of ground;
 Before me fell a stormy ocean.
 I was like a captive bound;
 And around
 A universe of sound
 Troubled the heavens with ever-quivering motion.
3. Down, down forever—down, down forever,
 Something falling, falling, falling,
 Up, up forever—up, up forever,
 Resting never,
 Boiling up forever,
 Steam-clouds shot up with thunder-bursts appalling.
4. A tone that since the birth of man
 Was never for a moment broken,
 A word that since the world began,
 And waters ran,
 Hath spoken still to man—
 Of God and of Eternity hath spoken.
5. Foam-clouds there forever rise
 With a restless roar o'erboiling—
 Rainbows stooping from the skies
 Charm the eyes,
 Beautiful they rise,
 Cheering the cataracts to their mighty toiling.
6. And in that vision, as it passed,
 Was gathered terror, beauty, power;
 And still, when all has fled, too fast,
 And I at last
 Dream of the dreamy past,
 My heart is full when lingering on that hour.—*Anon.*

EIGHTH MISCELLANEOUS DIVISION.



LESSON I.—THE WAYSIDE SPRING.

1. FAIR dweller by the dusty way—
Bright saint within a mossy shrine,
The tribute of a heart to-day
Weary and worn is thine.
2. The earliest blossoms of the year,
The sweet-brier and the violet,
The pious hand of spring has here
Upon thy altar set.
3. And not alone to thee is given
The homage of the pilgrim's knee—

- But oft the sweetest birds of heaven
Glide down and sing to thee.
4. Here daily from his beechen cell
The hermit squirrel steals to drink,
And flocks which cluster to their bell
Recline along thy brink.
5. And here the waggoner blocks his wheels,
To quaff the cool and generous boon ;
Here, from the sultry harvest fields
The reapers rest at noon.
6. And oft the beggar, marked with tan,
In rusty garments gray with dust,
Here sits and dips his little can,
And breaks his scanty crust ;
7. And, lulled beside thy whispering stream,
Oft drops to slumber unawares,
And sees the angel of his dream
Upon celestial stairs.
8. Dear dweller by the dusty way,
Thou saint within a mossy shrine,
The tribute of a heart to-day
Weary and worn is thine !—READ.

LESSON II.—THE HEADSTONE.

1. THE coffin was let down to the bottom of the grave, the planks were removed from the heaped-up brink, the first rattling clods had struck their knell, the quick shoveling was over, and the long, broad, skillfully cut pieces of turf were aptly joined together, and trimly laid by the beating spade, so that the newest mound in the church-yard was scarcely distinguishable from those that were grown over by the undisturbed grass and daisies of a luxuriant spring. The burial was soon over ; and the party, with one consenting motion, having uncovered their heads in decent reverence of the place and occasion, were beginning to separate, and about to leave the church-yard.

2. Here some acquaintances from distant parts of the parish, who had not had opportunity of addressing each other in the house that had belonged to the deceased, nor in the course of the few hundred yards that the little procession had to move over from his bed to his grave, were shaking hands quietly but cheerfully, and inquiring after the welfare of each other's families. There a small knot of neighbors were speaking, without exaggeration, of the respectable character which the deceased had borne, and mentioning to one another little

incidents of his life, some of them so remote as to be known only to the gray-headed persons of the group; while a few yards farther removed from the spot were standing together parties who discussed ordinary concerns, altogether unconnected with the funeral, such as the state of the markets, the promise of the season, or change of tenants; but still with a sobriety of manner and voice that was insensibly produced by the influence of the simple ceremony now closed, by the quiet graves around, and the shadow of the spire and gray walls of the house of God.

3. Two men yet stood together at the head of the grave, with countenances of sincere but impassioned grief. They were brothers, the only sons of him who had been buried. And there was something in their situation that naturally kept the eyes of many directed upon them for a long time, and more intently than would have been the case had there been nothing more observable about them than the common symptoms of a common sorrow. But these two brothers, who were now standing at the head of their father's grave, had for some years been totally estranged from each other; and the only words that had passed between them during all that time had been uttered within a few days past, during the necessary preparations for the old man's funeral.

4. No deep and deadly quarrel was between these brothers, and neither of them could distinctly tell the cause of this unnatural estrangement. Perhaps dim jealousies of their father's favor—selfish thoughts that will sometimes force themselves into poor men's hearts respecting temporal expectations—unaccommodating manners on both sides—taunting words which mean little when uttered, but which rankle and fester in remembrance—imagined opposition of interests that, duly considered, would have been found one and the same—these, and many other causes, slight when single, but strong when rising up together in one baneful band, had gradually but fatally infected their hearts, till at last they, who in youth had been seldom separate and truly attached, now met at market, and, miserable to say, at church, with dark and averted faces, like different clansmen during a feud.

5. Surely, if any thing could have softened their hearts toward each other, it must have been to stand silently, side by side, while the earth, stones, and clods were falling down upon their father's coffin. And doubtless their hearts were so softened. But pride, though it can not prevent the holy affections of nature from being felt, may prevent them from

being shown; and these two brothers stood there together, determined not to let each other know the mutual tenderness that, in spite of them, was gushing up in their hearts, and teaching them the unconfessed folly and wickedness of their causeless quarrel.

6. A headstone had been prepared, and a person came forward to plant it. The elder brother directed him how to place it—a plain stone, with a sand-glass, skull, and cross-bones, chiseled not rudely, and a few words inscribed. The younger brother regarded the operation with a troubled eye, and said, loudly enough to be heard by several of the by-standers, “William, this was not kind in you; you should have told me of this. I loved my father as well as you could love him. You were the elder, and, it may be, the favorite son; but I had a right in nature to have joined you in ordering this headstone, had I not?”

7. During these words the stone was sinking into the earth, and many persons who were on their way from the grave returned. For a while the elder brother said nothing, for he had a consciousness in his heart that he ought to have consulted his father’s son in designing this last becoming mark of affection and respect to his memory; so that the stone was planted in silence, and now stood erect, decently and simply, among the other unostentatious memorials of the humble dead.

8. The inscription merely gave the name and age of the deceased, and told that the stone had been erected “by his affectionate sons.” The sight of these words seemed to soften the displeasure of the angry man, and he said, somewhat more mildly, “Yes, we were his affectionate sons; and, since my name is on the stone, I am satisfied, brother. We have not drawn together kindly of late years, and perhaps never may; but I acknowledge and respect your worth; and here, before our own friends, and before the friends of our father, with my foot above his head, I express my willingness to be on other and better terms with you; and if we can not command love in our hearts, let us, at least, brother, bar out all unkindness.”

9. The minister who had attended the funeral, and had something intrusted to him to say publicly before he left the church-yard, now came forward and asked the elder brother why he spake not regarding this matter. He saw that there was something of a cold and sullen pride rising up in his heart, for not easily may any man hope to dismiss from the

chamber of his heart even the vilest guest, if once cherished there. With a solemn and almost severe air he looked upon the relenting man, and then, changing his countenance into serenity, said gently,

"Behold, how good a thing it is,
And how becoming well,
Together such as brethren are,
In unity to dwell!"

10. The time, the place, and this beautiful expression of a natural sentiment, quite overcame a heart in which many kind, if not warm affections dwelt; and the man thus appealed to bowed down his head and wept. "Give me your hand, brother;" and it was given, while a murmur of satisfaction arose from all present, and all hearts felt kindlier and more humanely toward each other.

11. As the brothers stood fervently but composedly grasping each other's hand, in the little hollow that lay between the grave of their mother, long since dead, and of their father, whose shroud was haply not yet still from the fall of dust to dust, the minister stood beside them with a pleasant countenance, and said, "I must fulfill the promise I made to your father on his death-bed. I must read to you a few words which his hand wrote at an hour when his tongue denied its office. I must not say that you did your duty to your old father; for did he not often beseech you, apart from one another, to be reconciled, for your own sakes as Christians, for his sake, and for the sake of the mother who bare you? When the palsy struck him for the last time, you were both absent; nor was it your fault that you were not beside the old man when he died.

12. "As long as sense continued with him here, did he think of you two, and of you two alone. Tears were in his eyes; I saw them there, and on his cheek too, when no breath came from his lips. But of this no more. He died with this paper in his hand; and he made me know that I was to read it to you over his grave. I now obey him. 'My sons, if you will let my bones lie quiet in the grave, near the dust of your mother, depart not from my burial till, in the name of God and Christ, you promise to love one another as you used to do. Dear boys, receive my blessing.'"

13. Some turned their heads away to hide the tears that needed not to be hidden; and when the brothers had released each other from a long and sobbing embrace, many went up to them, and, in a single word or two, expressed their joy at this perfect reconciliation. The brothers themselves walked

away from the church-yard arm in arm, with the minister, to the manse. On the following Sabbath they were seen sitting with their families in the same pew, and it was observed that they read together off the same Bible when the minister gave out the text, and that they sang together, taking hold of the same psalm-book. The same psalm was sung (given out at their own request), of which one verse had been repeated at their father's grave; a larger sum than usual was on that Sabbath found in the plate for the poor, for Love and Charity are sisters. And ever after, both during the peace and the troubles of this life, the hearts of the brothers were as one, and in nothing were they divided.

JOHN WILSON (CHRISTOPHER NORTH).

LESSON III.

I. THE SEASONS OF LIFE.

THE days of infancy are all a dream,
How fair, but oh! how short they seem—
'Tis Life's sweet opening SPRING.

The days of youth advance;
The bounding limb, the ardent glance,
The kindling soul they bring—
It is Life's burning SUMMER time.

Manhood—matured with wisdom's fruit,
Reward of learning's deep pursuit—
Succeeds, as AUTUMN follows Summer's prime.

And that, and that, alas! goes by;
And what ensues? The languid eye,
The failing frame, the soul o'ercast;
'Tis WINTER's sickening, withering blast,
Life's blessed season—for it is the last.—SOUTHEY.

II. SMALL THINGS.

A sense of an earnest will
To help the lowly living,
And a terrible heart-thrill,
If you have no power of giving;
An arm of aid to the weak,
A friendly hand to the friendless;
Kind words, so short to speak,
But whose echo is endless:
The world is wide—these things are small;
They may be nothing—but they may be all.

III. HOW WE SHOULD LIVE.

So should we live, that every hour
May die as dies the natural flower,
A self-revolving thing of power.

That every thought and every deed
May hold within itself the seed
Of future good and future need :

Esteeming sorrow, whose employ
Is to develop, not destroy,
Far better than a barren joy.

IV. TO MY SON.

My son, be this thy simple plan :
Serve God, and love thy brother man ;
Forget not, in temptation's hour,
That sin lends sorrow double power ;
Count life a stage upon thy way,
And follow Conscience, come what may ;
Alike with earth and heaven sincere,
With hand, and brow, and bosom clear,
" Fear God, and know no other fear."

LESSON IV.—THE STREAM OF LIFE.

1. LIFE bears us on like the stream of a mighty river. Our boat at first glides down the narrow channel, through the playful murmuring of the little brook and the winding of its grassy border. The trees shed their blossoms over our young heads, the flowers on the brink seem to offer themselves to our young hands ; we are happy in hope, and we grasp eagerly at the beauties around us ; but the stream hurries on, and still our hands are empty.

2. Our course in youth and manhood is along a wider and deeper flood, amid objects more striking and magnificent. We are animated by the moving picture of enjoyment and industry passing before us ; we are excited by some short-lived disappointment. The stream bears us on, and our joys and our griefs are alike left behind us.

3. We may be shipwrecked, but we can not be delayed ; whether rough or smooth, the river hastens toward its home, till the roar of the ocean is in our ears, and the tossing of its waves is beneath our feet, and the land lessens from our eyes, and the floods are lifted up around us, and we take our leave of earth and its inhabitants, until of our farther voyage there is no witness save the Infinite and Eternal.—HEBER.

PART IX.

FIRST DIVISION OF CHEMISTRY.

[This subject is continued in the Sixth Reader.]

LESSON I.—INTRODUCTORY VIEW.

1. THERE are three great divisions of the science of nature, and these are embraced in the departments of Natural History, Natural Philosophy, and Chemistry. Under the first are included zoology, botany, and geology, whose province it is to describe and classify all material things, both animate and inanimate. Natural Philosophy, taking natural objects as thus classified, treats of their general and permanent properties, of the laws which govern them, and the reciprocal action which, *without change of form or character*, and generally at appreciable distances, they are capable of exerting upon each other.

2. Chemistry advances farther in her investigations, and with scrutinizing minuteness leads us far into the hidden mysteries of nature. It treats of the intimate action of substances upon each other, such as chemical mixtures or combinations, which *always* result in *changes of form and character*. It presents to us, as a first lesson, the astonishing fact that, notwithstanding the countless variety of forms and properties of matter which nature presents to us as things essentially different, only about sixty elementary substances are known to exist, and that it is merely by their different combinations that they are made to present to our senses these infinite diversities.

3. Proceeding a little farther, our wonder increases on learning that nearly all the objects with which we are acquainted are, to use a common phrase, "made up" almost exclusively of at least not more than four of these elementary substances, and that these are the three gases, oxygen, hydrogen, and nitrogen, together with carbon. Indeed, charcoal and the diamond, though totally unlike each other, are composed of carbon alone. Water is formed of oxygen and hydrogen; the air we breathe, and the corrosive nitric acid, are alike composed of oxygen and nitrogen; vegetable substances, infinite in diversity of form and properties, are formed almost wholly of oxygen, hydrogen, and carbon; and ani-

mal substances are formed chiefly of these three elements, with the addition of nitrogen. So largely does oxygen enter into combinations with other elementary substances, that one half of the entire globe itself is said to be formed of this gas, or, as one writer has expressed it, "of compressed and hardened air."

4. How *one* substance can assume forms and properties so different as charcoal and the diamond, or how two or more substances, merely by different combinations of them, can produce things so totally unlike as common air and nitric acid, or as sugar and vinegar, we are unable to conceive; but chemistry teaches us the facts, and leaves us to ponder over such mysteries in wonder and admiration. But it is not merely a science that is full of wonders; in its various departments it is intimately related to all the other natural sciences, and it forms the basis of all the useful arts. Thus, what is termed *Inorganic Chemistry* treats of the laws of combination by which are formed all those compound bodies which are not the products of organized life. There is not a single manufacture or art, from the smelting of ore and the making of bread, to the manufacture of gunpowder and electric telegraphing, that is not more or less dependent upon this branch of chemistry.

5. In what is called *Organic Chemistry* we trace the combinations of the same elementary substances, and chiefly the three gases and carbon, as modified by the principle of life; and thus animal and vegetable chemistry are recognized as branches of one greater science. In *Agricultural Chemistry* we study the applications of chemistry to agriculture; and being made acquainted with the chemical ingredients of plants and soils, we are enabled so to avail ourselves of the laws of vegetable growth as to adapt our soils to the nature of the product required. Indeed, so extensive are the applications of chemical principles, that they enter, in some mode or form, into every branch of industry, and every department of civilized life.

LESSON II.—FIRST PRINCIPLES: ULTIMATE ATOMS.

1. WHEN a stick of wood is burned for fuel, it is *destroyed* as a *stick of wood*, but not one of the *particles*, or, more properly, *atoms*, which composed it, has been *annihilated*. In the ashes of the wood, and in the atmosphere in which it was

consumed, every atom must still exist. Some of these atoms may glisten in the morning dew, crystallize in the snow-flake, or fall to the waiting fields in the grateful rain. Other atoms of the stick of wood apparently destroyed may appear the next year in some stick of sugar-candy, and again, ages hence, may constitute a little but important part of some votive monument of marble. Such changes are not only possible, but probable.

2. When by the wind the tree is shaken,
There's not a bough or leaf can fall,
But of its falling heed is taken
By One that sees and governs all.
3. The tree may fall and be forgotten,
And buried in the earth remain;
Yet from its juices rank and rotten
Springs vegetating life again.
4. The world is with creation teeming,
And *nothing ever wholly dies*;
And things that are destroyed in seeming,
In other shapes and forms arise.
5. And Nature still unfolds the tissue
Of unseen works by spirit wrought;
And not a work but hath its issue
With blessing or with evil fraught.—KENNEDY.

6. The journey of an atom in its ceaseless round would be even more wonderful than the adventures of a drop of water—now in the ocean, next in the rainbow, then a part of an iceberg, and again on its way to the purple cloud. The ocean has been in the clouds—perhaps many times; and yet, in all its changes, not a particle has been lost.

7. "Nothing is lost: the drop of dew
Which trembles on the leaf or flower,
Is but exhaled to fall anew
In summer's thunder-shower;
Perchance to shine within the bow
That fronts the sun at fall of day,
Perchance to sparkle in the flow
Of fountains far away."

8. The plant is made of the mineral, and the animal consumes the plant and returns to the earth, again to enter into new combinations. *Shakspeare* says,

- "Imperious Cæsar, dead, and turn'd to clay,
Might stop a hole, to keep the wind away;
Oh that the earth, which kept the world in awe,
Should patch a wall to expel the winter's flaw!"

9. Another has expressed the same truth in the following words: "Man, moving to-day the monarch of a mighty people, in a few years passes back to his primitive clod, and that combination of elementary atoms which is dignified with the circle of sovereignty and the robe of purple, after a period may be sought for in the herbage of the fields and in the humble flowers of the valley."—HUNT.

10. We live in a world of change. The growth and composition of organic matter, the rusting of metals, the crumbling of rocks, and the combustion of fuel, afford innumerable illustrations of this truth. Nothing is at rest—nothing is permanent; and yet, in all the changes which matter has undergone, from creation's dawn to the present time, we have no reason for believing that the minutest atom has been destroyed. Let not man, then, condemn the atom which he could not create, and which he has not the power to destroy.

LESSON III.—THE MAN AND THE ATOM.

1. "SMALL atom, unconsidered,
Unfelt, and scarcely seen!
Thou hast no worth upon the earth—
So infinitely mean.
2. "Useless thou art, oh atom!
And, absolute in might,
If I decree thou shalt not be',
I can destroy thee quite."
3. "Ah! no; thy hand is powerless.
I hold a life too high;
A strength innate, as old as fate;
I change, but can not die.
4. "Destruction can not touch me;
The hand alone which wrought
My shape and thine—a hand divine—
Can hurl me into naught.
5. "Thou mayst on waters cast me,
Or loose me to the wind,
Or burn in fire, at thy desire,
So that thou canst not find;
6. "But I shall hold existence
To earth's remotest time,
And fill in space my destined place,
Though humble, yet sublime.
7. "Ere yet offending Adam
Fell from his pure estate,
Or tended flowers in Eden's bowers,
With Eve, his happy mate';
8. "I, even I, existed,
And played my proper part
In God's great plan—oh, little man,
Reflect on what *thou* art!
9. "Couldst thou destroy *my* being',
Thy hand might reach the spheres',
And bid the sun no longer run
His course among his peers.

10. "Be humble', brother atom';
Whate'er thy mortal growth
Or mine may be, humility
Alone becomes us both."—C. MACKAY.
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LES. IV.—CHEMICAL AGENTS: HEAT—LIGHT—ELECTRICITY.

1. THE number of substances not known to be *compounds* is upward of sixty; the names of which, the symbols by which they are designated in chemical books, and their combining proportions, are given in a note at the bottom of page 426. Nearly half of these *elements*, as they are called, are of rare occurrence, and not more than twenty of them are of much interest to any but the professed chemist. It is with these elements, which make up the whole material world, that chemistry deals; and its province is to point out and explain the agencies or active forces employed in effecting changes among them, the laws under which these changes are made, the properties of the elements and of their compounds, and, finally, the applications of the science to arts, manufactures, and agriculture. The latter division of the subject, although of exceeding interest and importance, must be reserved for the Sixth Reader.

2. The active forces of chemistry are *heat*, *light*, and *electricity*. By their separate or combined action the elements of matter are caused to unite, and sometimes compounds are decomposed into their original constituents, and new substances are formed.

3. Let us first glance at some of the chemical effects of *heat*. The matters of every-day life will furnish us abundant examples. *Lead* is one of the elementary substances. And who has not observed that when lead is melted, a scum or dross covers the surface, and that if it be kept long in a melted state it will disappear as metallic lead, and become dross altogether? But what has become of the lead? The heat has caused it to unite with a portion of the oxygen from the air, and form this dross; and if the heating process be continued long enough, the dross will unite with more oxygen and become *red lead*, a substance used in painting. The manufacture of this important article of commerce is merely an application of the chemical principle here illustrated—the combination of oxygen with common lead.

4. The red rust on iron nails and bolts found among the ruins of burned buildings shows that heat facilitates the com-

bination of iron and oxygen. It is frequently the case that one degree of heat will cause oxygen to unite with a metal, while a higher degree will cause a separation. It is the tendency of heat, moreover, to separate, in a greater or less degree, the particles or atoms of which a body is composed, and thus to enlarge its bulk so long as the force of heat is exerted. Advantage is taken of this expansive property in liquids in the construction of thermometers.

5. *Light* is another important chemical agent often associated with heat. But they may be separated from each other; and it can be proved that there is no correspondence between intense light and ardent heat. Milton says, addressing Light:

“Before the sun,
Before the heavens thou wert, and at the voice
Of God, as with a mantle, didst invest
The rising world of waters dark and deep,
Won from the void and formless infinite.”

6. As the cause of color, as the medium of vision, and as an agency influencing in a most striking manner all the forms of organization, and even affecting the crystallization of inorganic matter, *light* has always presented to inquiring minds a subject of the highest interest. Light paints the blush on the luscious peach, and spreads the “tender green” over the leaves of the forest and the grass of the meadows. The very shells of the ocean are almost colorless when taken from great depths, where the action of light is but feeble.

7. We see, daily, numberless instances of the chemical effects of light. In the sunshine some colors fade, and others become more intense. Many vegetables can be kept better in places deprived of light, and certain medicines must be kept in black bottles, or be otherwise protected from solar influence. Daguerreotypes and photographs are made by the chemical action of light on certain preparations of silver, or other substances very sensitive to its influences.

8. A mixture of two gaseous elements, *chlorine* and *hydrogen*, may be made in the dark, without exhibiting any tendency to unite; but if the bottle containing them be exposed to the sunlight, a violent explosion ensues, and a compound is formed, which is called hydrochloric acid.

9. Not only is light an indispensable agent in the growth of vegetables, but it is necessary to the proper development of animal life. How sensitive are our bodies to its influences! How our feelings sympathize with every change of the sky! When the sun shines, the blood flows freely, and our spirits are light and buoyant. Professor Johnston has said, in his

“Chemistry of Common Life,” that “the energy is greater, and the body is actually stronger in a bright than in a cloudy day.” There is science as well as poetry in the following address

TO THE SUNBEAM.

10. Thou art no lingerer in monarch's hall;
A joy thou art, and a wealth to all!
A bearer of hope upon land and sea—
Sunbeam! what gift hath the world like thee?
11. Thou art walking the billows, and ocean smiles—
Thou hast touched with glory his thousand isles—
Thou hast lit up the ships and the feathery foam,
And gladdened the sailor like words from home.
12. To the solemn depths of the forest shades,
Thou art streaming on through their green arcades;
And the quivering leaves that have caught thy glow,
Like fire-flies glance to the pools below.
13. I looked on the mountains—a vapor lay,
Folding their heights in its dark array;
Thou brokest forth—and the mist became
A crown and a mantle of living flame.
14. I looked on the peasant's lowly cot—
Something of sadness had wrapped the spot;
But the gleam of thee on its casement fell,
And it laughed into beauty at that bright spell.
15. To the earth's wild places a guest thou art,
Flushing the waste like the rose's heart;
And thou scornest not from thy pomp to shed
A tender light on the ruin's head.
16. Thou tak'st through the dim church aisles thy way,
And its pillars from twilight flash forth to day;
And its high pale tombs, with their trophies old,
Are bathed in a flood as of burning gold.
17. And thou turn'st not from the humblest grave,
Where a flower to the sighing winds may wave;
Thou scatterest its gloom like the gleams of rest,
Thou sleepest in love on its grassy breast.
18. Sunbeam of summer! oh, what is like thee?
Hope of the wilderness, joy of the sea!
One thing is like thee, to mortals given—
The FAITH, touching all things with hues of heaven.—MRS. HEMANS.

19. In striking contrast with the cheering and enlivening influences of the glorious sun is the scene presented by the dissolution and gloom described in Byron's *Dream of Darkness*, in which “the bright sun was extinguished.”

20. “The world was void,
The populous and the powerful was a lump,
Seasonless, herbless, treeless, manless, lifeless—
A lump of death—a chaos of hard clay.
The rivers, lakes, and ocean, all stood still,
And nothing stirred within their silent depths;
Ships, sailorless, lay rotting on the sea,
And their masts fell down piecemeal; as they dropped,
They slept on the abyss without a surge—
The waves were dead; the tides were in their grave;
The moon, their mistress, had expired before;
The winds were withered in the stagnant air,
And the clouds perished; Darkness had no need
Of aid from them—she was the universe.”

LESSON V.—CHEMICAL AGENTS CONTINUED.

ELECTRICITY.

1. WHEN certain substances, such as glass, amber, and sealing-wax, are rubbed with dry silk or cloth, they acquire a power of first attracting bits of paper and other light substances, and afterward of repelling them. The same power manifests itself, only in a different way, in the thunder-cloud when it shakes the earth with its explosions; it resides, though often silent, unfelt, and unseen, in every particle of air, in every drop of water, and in the solid earth; directing the needle to the pole, it guides the mariner in his course; and modern science has trained it to transmit intelligence, literally, with "lightning speed."

2. In the great laboratory of nature this power is doubtless the chief agent by which chemical changes are wrought; and in "earth's hidden chambers" it is believed to be constantly in operation, separating compounds, and from their elements forming new combinations. Modern science has learned to imitate, though on a feeble scale, some of its wonders; and although it has not discovered the long-sought "philosopher's stone," which was supposed to be able to transmute the baser metals into gold, it has, nevertheless, in the development which it has given to the useful arts, done a better service to mankind than the older alchemists ever dreamed of.

3. The question, "What *is* electricity?" is more easily asked than answered; but we see its effects all around us, and can tell what it *does*. A flash of lightning is an electrical phenomenon; and on a small scale we imitate it when, in a dry, cold atmosphere, and in the dark, we produce sparks of light by briskly rubbing a strip of paper with India-rubber, glass with a dry cloth, or, in the perhaps more familiar experiment, by rubbing the hair on a cat's back. By the aid of a powerful electrical machine we may collect a sufficient quantity of this "electric fluid" to kill a man by its explosion.

4. By the aid of this same "fluid" we may also decompose water, resolving it into its two elements, oxygen and hydrogen; and again, if these two constituents be collected and mixed in a suitable glass vessel, and a spark of electricity be passed through them, they will combine *with explosive force*, and form the original quantity of water.

5. Yet most frequently electrical phenomena are silent op-

erations, caused by means that can be detected only by careful scrutiny. A tree or dwelling may be shivered when

"From cloud to cloud the rending lightnings rage;"

but the great work of electricity is performed in

"The stilly hour, when storms are gone,
When warring winds have died away,
And clouds, beneath the dancing ray,
Melt off and leave the land and sea
Sleeping in bright tranquillity."

It is chiefly in the form of what is called *galvanism* that the quiet but mighty operations of this power are carried on, as may be illustrated by the following experiment.

6. If we place a piece of zinc in dilute sulphuric acid, and extend a metallic wire from the dissolving zinc to a similar piece of copper, also immersed in the dilute acid, we form what is called a simple *galvanic battery*, and a faint electric spark may be seen whenever the contact of the wire with the copper is broken or closed. A current of what is called *galvanic electricity*, silent and unseen, may thus be created and be made to pass through the liquid; and by it gold, silver, and copper, dissolved in suitable acids, may be taken from the solution and deposited in a pure state, in a thin film or coating, on the surface of other metals—a process which is called by different names, as galvanizing, electro-plating, and electrotyping.

7. Such electrical currents are known to be in constant action beneath the surface of the earth, and even far down among the rocky strata; and it is probably by this quiet electric power, in connection with heat, that the mineral wealth of the earth—its gold, its silver, its iron, its crystals, its precious stones, and all the infinite variety of inorganic combinations of elementary substances—has been formed.

8. Thus electricity is found, in conjunction with heat or light, and sometimes with both, to be an all-pervading agent, assuming various forms and modes of action; but whether it is a material substance or not we can not tell. Like heat and light, it is called an *imponderable* agent, because, however much of it may be collected, it has no appreciable weight, and, like them, it is known only by its effects.

9. "That power which, like a potent spirit, guides
The sea-side wanderers over distant tides,
Inspiring confidence where'er they roam,
By indicating still the pathway home;
Through nature, quicken'd by the solar beam,
Invests each atom with a force supreme,
Directs the cavern'd crystal in its birth,
And frames the mightiest mountains of the earth,
Each leaf and flower by its strong law restrains,
And man, the monarch, binds in iron chains."

LESSON VI.—THE ELECTRIC TELEGRAPH.

1. THE greatest of modern inventions, next to the application of steam to the propulsion of machinery, is the application of galvanic electricity to the transmission of thought by means of the electric telegraph. An extensive series of the simple galvanic batteries before described may be made to produce effects so powerful, that metals which can not be fused at any furnace heat are readily melted by it; and by causing the electric current to pass repeatedly around a bar of iron or steel, the most powerful magnets are formed.

2. When the bar is of *soft* iron, it loses its magnetism as soon as the electric current is stopped; and by an ingenious contrivance, an instrument has been made by which the power of the soft iron magnet can be created and destroyed instantaneously any number of times in succession. Advantage is taken of this to work a needle which prints marks upon paper at the will of the operator. These marks, which are formed into an alphabet, the operator uses to spell out the words which he wishes to write. As the electric current may be made to pass through a wire thousands of miles in extent, an operator at one extremity of the wire can direct the motions of the needle at the other, and thus thought may be transmitted with lightning speed wherever the "wonder-working wire" can be extended. The transmission of thought in this way is indeed *swifter than light*, for the electric fluid flashes over the wire at the amazing rate of more than two hundred and eighty thousand miles in a second of time!

3. Hark! the warning needles click,
Hither—thither—clear and quick.
He who guides their speaking play
Stands a thousand miles away!
Here we feel the electric thrill
Guided by his simple will;
Here the instant message read,
Brought with more than lightning speed.
Sing who will of Orphean lyre,
Ours— the wonder-working wire!
4. Let the sky be dark or clear,
Comes the faithful messenger;
Now it tells of loss and grief,
Now of joy in sentence brief,
Now of safe or sunken ships,
Now the murderer outstrips,
Now of war and fields of blood,
Now of fire, and now of flood.
Sing who will of Orphean lyre,
Ours— the wonder-working wire!
5. Think the thought, and speak the word,
It is caught as soon as heard.

Borne o'er mountains, lakes, and seas,
 To the far antip'odes;
 Boston speaks at twelve o'clock,
 Natchez reads ere noon the shock:
 Seems it not a feat sublime?
 Intellect has conquered time!

Sing who will of Orphean lyre,
 Ours the wonder-working wire!

6

Marvel! triumph of our day,
 Flash all ignorance away!
 Flash sincerity of speech—
 Noblest aims to all who teach;
 Flash till power shall learn the right,
 Flash till reason conquer might;
 Flash resolve to every mind—
 Manhood flash to all mankind!

Sing who will of Orphean lyre,
 Ours the wonder-working wire!—*Anonymous.*

LESSON VII.—CHEMICAL AFFINITIES.

1. AMONG all the wonders of the material world, there are none greater than those which are exhibited in the likings, or *affinities*, which the different elementary particles or atoms show for each other. Each readily forms an intimate union with some, while it repels others as if disdaining any relationship; and, moreover, where two kinds of matter show an affinity or congeniality, they will unite in certain definite proportions, and in no other.

2. Let us begin with that all-abundant element oxygen, and exhibit some of its affinities for other elements, which are so strong that it is never found by itself, unless under compulsion. It is the only element which is capable of uniting with all others, with perhaps a single exception. In forming water, just *eight* parts of oxygen by weight unite with *one* part of hydrogen, and in no other proportions will they form water. Yet eight additional parts of oxygen, that is, sixteen parts, will unite with one of hydrogen, but the compound is a bitter, disagreeable liquid.

3. Oxygen will unite with nitrogen in the proportion of eight parts of oxygen to *fourteen* of nitrogen, and with carbon in the proportion of eight parts of oxygen to *six* of carbon. We have thus given the most simple combining proportions of these four elementary substances, that of hydrogen being taken as the standard; and it is found that, with whatever elements they combine, they never vary from these proportions, or *multiples* of these. Thus the combining proportions of oxygen are always 8, 16, 24, 32, 40, or some higher multiple of 8; and the combining proportions of carbon are 6, 12, 18, 24, 30, or some higher multiple of 6. A similar prin-

ciple is found to apply to all other elementary substances, each having its combining proportion, or *chemical equivalent*, from which, or some multiple of which, it never varies.*

4. As we can form no conception of the number of combinations that may arise from sixty-one elements, so we can form no estimate of the number of different compounds to which their union may give rise; for we must remember that a difference in the *proportions* of the elements—and sometimes a mere difference in the *arrangement*—may constitute very different things. An instance of this is seen in the composition of *vinegar, sugar, alcohol, and starch*, neither one of which contains any element not in the others.

LESSON VIII.—LEADING CHARACTERISTICS OF THE FOUR PRINCIPAL ELEMENTS: OXYGEN—HYDROGEN—CARBON—NITROGEN.

Four elements in one firm band
Give form to life, build sea and land.—SCHILLER.

1. The leading characteristics of *oxygen* are, that it is the supporter of combustion—as fire will not burn without its presence—and it is also the life-sustaining element in the air we breathe. When a piece of charcoal, which is pure carbon, is burned in the open air, the combustion consists in the union of the carbon of the charcoal with the oxygen of the

* The following table comprises a list of all the elementary substances now known, the symbols by which they are designated in chemical books, and the equivalents, or parts by weight, in which they unite to form compounds. It must be remembered that the equivalent numbers express nothing but the *relative* weights in which the elements unite with each other. Hydrogen is here taken as the standard, to which all the others are referred. The names of those which are comparatively unimportant are printed in italics.

Non-metallic Elements.	Sym.	Equiv.	Metallic Elements.	Sym.	Equiv.	Metallic Elements.	Sym.	Equiv.
Oxygen	O.	8.00	Calcium	Ca.	20.00	<i>Norrium</i>	No.	.....
Hydrogen	H.	1.00	Cerium	Ce.	47.00	<i>Osmium</i>	Os.	99.60
Nitrogen	N.	14.00	Chromium	Cr.	26.70	<i>Palladium</i>	Pd.	53.80
Carbon	C.	6.00	Cobalt	Co.	29.50	Platinum	Pt.	98.70
Sulphur	S.	16.00	<i>Columbium</i>	Ta.	68.80	Potassium	K.	39.20
Phosphorus	P.	31.00	Copper	Cu.	31.70	<i>Rhodium</i>	Rh.	52.20
Chlorine	Cl.	35.50	<i>Dilidium</i>	D.	48.00	<i>Ruthenium</i>	Ru.	52.20
Bromine	Br.	80.00	Erbium	E.	.....	Silver	Ag.	108.00
Iodine	I.	127.00	<i>Glucium</i>	G.	4.70	Sodium	Na.	23.00
Fluorine	F.	19.00	Gold	Au.	197.00	Strontium	Sr.	43.75
Boron	B.	10.90	<i>Iridium</i>	Ir.	99.00	<i>Tellurium</i>	Te.	64.00
Silicon	Si.	21.00	Iron	Fe.	28.00	<i>Terbium</i>	Tb.	.....
<i>Selenium</i>	Se.	40.00	<i>Lanthanum</i>	La.	47.00	<i>Thorium</i>	Th.	59.60
Metallic Elements.			Lead	Pb.	103.50	Tin	Sn.	59.00
Aluminium	Al.	13.75	<i>Lithium</i>	Li.	7.00	Titanium	Ti.	25.00
Antimony	Sb.	122.00	Magnesium	Mg.	12.50	Tungsten	W.	92.00
Arsenic	As.	75.00	Manganese	Mn.	27.50	Uranium	U.	60.00
Barium	Ba.	68.50	Mercury	Hg.	100.00	<i>Vanadium</i>	V.	68.60
Bismuth	Bi.	214.00	<i>Molybdenum</i>	Mo.	48.00	<i>Yttrium</i>	Y.	.....
<i>Calcium</i>	Cd.	56.00	Nickel	Ni.	29.50	Zinc	Zn.	32.75
			<i>Niobium</i>	Nb.	.....	<i>Zirconium</i>	Zr.	22.40

air, forming the compound, *carbonic acid*. When wood is burned, the process and result are the same, with the exception that the wood is not wholly carbon, and the other ingredients appear during the combustion in the form of smoke and ashes. The rusting of metals is a slow combustion, termed *oxidation*; and whenever oxygen unites with any other element, some degree of heat is evolved in the process.

2. Iron and steel, and other metals, will burn with exceeding brilliancy in oxygen gas; and, what is more strange, the most intense heat known is produced by burning oxygen and hydrogen in the proportions which form water.* Although no two things in nature are more opposite in character than fire and water, yet in this burning process the water is the product of the fire! Oxygen is heavier than common air, and may be poured from one vessel into another; yet it is invisible, inodorous, and tasteless, and can be detected only by its effects upon other bodies.

3. "As a candle burns in oxygen gas with much greater brilliancy and rapidity than in common air, so animals breathe in it with an increase of pleasure; but it excites them, quickens their circulation, throws them into a state of fever, and finally kills them by excess of excitement. They live too rapidly in pure oxygen gas, and burn away in it like the fast-flaring candle."—JOHNSTON.

4. *Hydrogen* is the lightest and most attenuated form of matter with which we are acquainted, being fourteen and a half times lighter than common air; hence it is the most suitable gas for inflating balloons. Though forming two thirds of the bulk of water and one ninth of its weight, it is highly inflammable when brought in contact with the oxygen of the atmosphere. Hence, when it is found, as often happens, in coal-mines, united with carbon from the coal and with oxygen, the mixture which is known as *fire-damp* is highly dangerous to life, as it is liable to violent explosions when lighted by accident. Moreover, those who escape the fire are liable to be suffocated by the carbonic acid which it produces.

5. The danger from *fire-damp*, however, has been in great part removed by the miners' "safety lamp," invented by Sir Humphrey Davy. He found that the flame of a lamp would not ignite bodies through a fine wire gauze; and by inclosing the miners' lamp within this cheap material, he was enabled both to indicate, by its waning light, the presence of a gas which is fatal to life if long respired, and also to guard

* The arrangement for burning oxygen and hydrogen for the purpose of fusing metals, melting glass, etc., is called the oxyhydrogen blowpipe.

against the dreadful effects of an explosion. Thousands may attribute their safety to

"That lamp's metallic gauze,
That curtain of protecting wire,
Which Davy delicately draws
Around explosive, dangerous fire."

6. As intense heat may cause the decomposition of water, and set free both the inflammable hydrogen and the oxygen which it contains, so, when water is thrown on a burning building in such quantity as not to quench the fire, it may add fuel to the flames. "Setting the river on fire" is by no means an impossibility, although it would not prove a very economical fuel.

7. *Carbon*, found in a solid state in charcoal and in the diamond, and in crystallized form in the latter, unites readily with oxygen to form *carbonic acid*. With hydrogen it unites to form a numerous class of compounds. It also forms nearly one half of the solid parts of all plants; and hence, in the economy of vegetation, it performs a most important part.

8. As carbonic acid, which is poisonous to animals when breathed in quantities, is produced both by the process of combustion and by the breathing of animals, the atmosphere would soon become unfit for respiration unless nature had provided some way for removing this deleterious compound. This process is performed by growing vegetables, as already explained; and so well do the operations by which this gas is produced and removed harmonize, that it is never found in excess in places left free to the circulation of the air.*

9. Any one who wishes to test the character of carbonic acid may do so by pouring vinegar upon common soda, but he must be cautious about inhaling the fumes which arise. What is very singular about this gas is, that although it can not be taken into the lungs without injury, considerable quantities of it may be swallowed with impunity; for it is this same gas which gives their sparkling briskness to fermented liquors, to soda-water, and to the waters of some mineral springs.

10. *Nitrogen*, which is known to us only in the form of a gas, is destitute of either taste, smell, or color. It supports neither combustion nor respiration; a lighted taper introduced into it is immediately extinguished, and animals placed within it soon die. Yet it forms nearly four fifths, by bulk,

* For the properties of *carbonic acid*, and the effects of breathing it, etc., read pages 54, 55, and 56 of Fourth Reader; its absorption, as food, by vegetables, see p. 208 Fourth Reader; and for the general principles by which nature harmonizes its production and consumption, see the lesson on "The Aquaria," p. 268 of this Reader.

of the air we breathe; and although it is not known to enter into the composition of any of the great mineral masses of the earth, it forms a considerable part of most animal and some vegetable substances.

11. Nitrogen is remarkable for its negative properties; and as it enters reluctantly into union with most other elementary substances, and is quite prone to escape from them, it forms very unstable compounds. In the decay of animal and vegetable matter it escapes into the air in the form of *ammonia*, a compound of hydrogen and nitrogen, which is the chief ingredient of all animal and vegetable manures. When united with oxygen in certain proportions, it forms the well known corrosive substance called nitric acid or aqua fortis, an article of great value in the arts.

LES. IX.—CHEMICAL KNOWLEDGE AND THE USEFUL ARTS.

SULPHUR AND CHLORINE.

1. As we have not space to treat of all the elementary substances and their combinations, we select here two, sulphur and chlorine, for the purpose of illustrating the bearings of chemical knowledge upon the arts of civilized life.

2. Why has Great Britain imported annually from the vicinity of southern Italy the enormous quantity of 60,000 tons of sulphur? Why have a million and a half dollars in gold, or their equivalent, been exchanged for such a substance as brimstone in a single year? It must be because the English people preferred sulphur to gold. Why such a strange preference the reader may reasonably inquire.

3. It was not to make gunpowder, and friction matches, as might at first be supposed, but to maintain and promote civilization through the medium of some of the most useful arts. Without sulphur the processes of bleaching, dying, metal-refining, soda-making, and electro-telegraphing would cease; and the stock of the druggist, and of the dealer in paints, could not be replenished.

4. Sulphur may well be called the key which opens the door to chemical manufactures. In combination with oxygen, under the name of sulphuric acid, it forms a compound necessary in almost every process of manufacturing industry. Although found principally in volcanic regions, sulphur is present in all soils where turnips, cabbages, or mustard will grow to maturity, as is shown by its presence in the seeds

of such plants. A silver spoon used in preparations of mustard is blackened by the contained sulphur. Sulphur is found also in eggs, as is shown in the same manner.

5. *Chlorine* is the name of another very important element, which, like sulphur, is extensively used for bleaching purposes, and also for the removal of noxious effluvia. It is obtained pure only in the form of a gas; but with the metals it forms many important combinations. The ocean is its great reservoir, where it combines with sodium to form common salt. *One* atom, or proportion, of chlorine, combined with *one* of mercury, forms calomel—a powder well known to those who take “doctors’ stuff;” and *two* atoms of chlorine with *one* of mercury make that deadly poison called corrosive sublimate. It is well to remember that the white of eggs is an effectual antidote for this poison, if taken in season.

6. Chlorine enters into the composition of many vegetable products; and experiments have shown that the germination of seeds is promoted by its presence. The most explosive substance known is a compound of chlorine and nitrogen; and if the chemical affinity existing between the elements of common table-salt were to be suspended for a moment, the very contents of the salt-cellar might prove fatal to the inmates of a closed room in which such separation of elements should occur.

LES. X.—THE PRINCIPAL METALS: GOLD—SILVER—IRON.

1. THESE are simple elementary substances, so far as is yet known; for all the efforts of chemical art have failed either to decompose them, or to form them by the combination of other elements. Of these, *gold* is deemed the most precious; as it is not only the most ductile and malleable of all the metals, but, being a very dense, fixed substance, and not liable to changes by exposure to the air, it is well fitted to be used as coin, and hence is in universal demand. Therefore it is that

2.

For gold the merchant plows the main,
The farmer plows the manor.—BURNS.
Gold! gold! gold!
Bright and yellow, hard and cold,
Molten, graven, hammered, and rolled,
Heavy to get, and light to hold,
Hoarded, bartered, bought, and sold,
Stolen, borrowed, squandered, doled,
Spurned by the young, but hugged by the old
To the very verge of the church-yard mould;
Pride of many a crime untold;
Gold! gold! gold! gold!
Good or bad a thousand-fold,

How widely its uses vary :
 To save, to ruin, to curse, to bless ;
 Now stamped with the image of the good Queen Bess,
 And now of "Bloody Mary."—Hoop.

3. The most interesting chemical property of gold is its want of affinity for oxygen ; hence gold will not rust, nor suffer corrosion by contact with any of the common acids ; and when gold used for coin or for gilding tarnishes, it is because it is alloyed with copper or other metal. But, although gold is the heaviest and most dense of all substances except platinum, like ice it has been liquefied in the laboratory of the chemist, and even converted into *gold steam* ; yet its properties as gold have never been changed by human art.

4. Notwithstanding the great value of gold, it is not so useful for many purposes as iron. Glaucus made a good bargain when he exchanged his *golden* armor with Diomedes for one of *brass*, although Homer has told us that

"Jove, of sober judgment so bereft
 Infatuate Glaucus', that with Tideus' son
 He bartered gold' for brass—a *hundred* beeves
 In value', for the value small of *nine*'."

Yet in point of lightness, and in power of resisting the weapons of the enemy, the *brass* armor was better than the one of gold.

5. Pure silver, like gold, is sometimes found in veins in granite and other primary rocks, where it was doubtless deposited, ages gone by, by chemical agencies. Pure silver is not acted upon by common acids ; but nitric acid dissolves it, forming nitrate of silver, or *lunar caustic*, which has the property of turning black on exposure to solar light. This is the chief ingredient in indelible ink, and it is also used in the preparations of the photographer.

6. Silver can be drawn into a wire much finer than the human hair ; and it is this wire, gilded, that is manufactured into what is called gold or silver lace. We certainly do not know of a more appropriate use to which this lace has been put than is stated in the following account of the *Silver Bird's-nest* ; and we think no one will be apt to forget the ductile property of silver, after associating it with so beautiful an illustration.

7. "A stranded soldier's epaulet
 The waters cast ashore,
 A little winged rover met,
 And eyed it o'er and o'er.
 The silver bright so pleased her sight,
 On that lone, idle vest,
 She knew not why she should deny
 Herself a silver nest.
8. The shining wire she peck'd and twirl'd ;
 Then bore it to her bough,

Where on a flowery twig 'twas curl'd,
The bird can show you how;
But when enough of that bright stuff
The cunning builder bore
Her house to make, she would not take,
Nor did she covet more.

9.

And when the little artisan,
While neither pride nor guilt
Had enter'd in her pretty plan,
Her resting-place had built,
With here and there a plume to spare
About her own light form,
Of these, inlaid with skill, she made
A lining soft and warm.

10.

But do you think the tender brood
She fondled there, and fed,
Were prouder when they understood
The sheen about their bed?
Do you suppose they ever rose,
Of higher powers possess'd,
Because they knew they peep'd and grew
Within a SILVER nest?—H. F. GOULD.

11. And now last, though not least, we have to consider some of the properties, chemical and otherwise, of that very common metallic substance, *iron*. We hazard nothing in asserting that it is by far the most useful of the metals. The smelting of the ore, and the fashioning of the metal by hammer and fire, must have been understood at a very early day in the world's history; for we read in the fourth chapter of Genesis that "Tubal Cain was an instructor of every artificer in brass and iron." And truly a "man of note," as well as a "man of might," he must have been, as a modern poet has sung:

12.

"Old Tubal Cain was a man of might,
In the days when earth was young;
By the fierce red light of his furnace bright,
The strokes of his hammer rung;
And he lifted high his brawny hand
On the iron glowing clear,
Till the sparks rushed out in scarlet showers,
As he fashioned the sword and spear.
And he sang, 'Hurrah for my handiwork!
Hurrah for the spear and the sword!
Hurrah for the hand that shall wield them well,
For he shall be king and lord!' "—MACKAY.

13. In combination with oxygen and sulphur, iron is so widely diffused that few minerals can be found that do not contain traces of it. Combined with oxygen, it is the coloring matter of our most beautiful marbles, as well as of clays and soils; and were it not for the wide dissemination of oxides of iron, the earthy matter of the globe would be as white as chalk. The artist derives some of his richest tints from iron.

Ye rivaled the tints of the blushing dawn
With the hues my dust supplied,
Till the humblest work of art has shown
Like the mist by rainbows dyed.—CUTTER.

14. Iron is found in the blood, where it performs important offices, conveying the oxygen of the air we breathe *from* the lungs to our very fingers' ends, and bearing back from the capillaries the waste carbon that requires to be thrown out of the system. It is also much used in medicine; and the tonic properties of those mineral springs called *chalybeate* are due to the presence of iron.

I come where the suffering patient lies
On his couch, all wan and weak,
And the lustre returns to his sunken eyes,
And the bloom to his pallid cheek.—CUTTER.

15. Iron is the only metal that combines with carbon, forming *steel* when the proportion of carbon is small, and black-lead or plumbago when the proportion is very large. Cast-iron contains earthy impurities and some carbon, which must be burned out to render the iron malleable. Some of the manifold uses and applications of iron or steel are enumerated in the following lines:

"Iron vessels cross the ocean,
Iron engines give them motion;
Iron needles northward veering,
Iron tillers vessels steering;
Iron pipe our gas delivers,
Iron bridges span our rivers;
Iron pens are used for writing,
Iron ink our thoughts inditing;
Iron stoves for cooking victuals,
Iron ovens, pots, and kettles;
Iron horses draw our loads,
Iron rails compose our roads;
Iron anchors hold in sands,
Iron bolts, and rods, and bands;
Iron houses, iron walls,
Iron cannon, iron balls;
Iron axes, knives, and chains,
Iron augers, saws, and planes;
Iron globules in our blood,
Iron particles in food;
Iron lightning-rods on spires,
Iron telegraphic wires;
Iron hammers, nails, and screws—
Iron every thing we use."

LESSON XI.—ACIDS, ALKALIES, AND SALTS.

1. In common language, an *acid* is any *sour* substance, but in chemistry the term is more extended. An *alkali*, a term originally applied to the ashes of plants, is a substance which has a peculiar acrid taste, like potash or soda. The acids and alkalies have a remarkable affinity for each other, uniting with the greatest facility, losing thereby their distinctive qualities, and by their union forming a large class of compounds which are known in chemistry as *salts*. This latter

term, therefore, though in ordinary language limited to common salt, is applied in chemistry to all combinations of acids with alkalies.

2. That common article, soap, is formed by the union of an alkali with the fatty acid of some oily substance; and hence soap itself may be considered one of the chemical salts. The alkali most frequently used is the common ley of wood ashes, which is essentially the same as pearlash or potash dissolved in water. It is well known that oil and water have no disposition to unite; but the alkali has a strong affinity for both, and in uniting with them brings about a mutual combination differing from either of the ingredients. The principles displayed in this process are well illustrated in the following

EASY LESSON IN CHEMISTRY.

3.

“Some water and oil
One day had a broil,
As down in a glass they were dropping,
And would not unite,
But continued to fight,
Without any prospect of stopping.
Some pearlash o’erheard—
As quick as a word,
He jumped in the midst of the clashing;
When all three agreed,
And united with speed,
And soap was created for washing.”

4. The commonness of an article is apt to induce us to overlook its importance; a truth which is perhaps nowhere more fully exemplified than in the case before us. Liebig says, “The quantity of soap consumed by a nation would be no inaccurate measure whereby to estimate its wealth and civilization.” According to Pliny, the invention of soap must be ascribed to the Gauls, by whom, he says, it was composed of tallow and ashes, and was probably at first an accidental combination. Homer had long before described the washing of the royal robes in the “limpid streams;” but we have reason to suspect, from the known absence of soap on that occasion, that the picture of their “snowy lustre” is overdrawn.

They seek the cisterns where Phœacian dames
Wash their fair garments in the limpid streams;
Where, gathering into depth from falling rills,
The lucid wave a spacious basin fills;
Then, emulous, the royal robes they lave,
And plunge the vestures in the cleansing wave:
The vestures cleansed o’erspread the shelly sand,
Their snowy lustre whitens all the strand.

POPE'S *Odyssey*, b. vi.

LESSON XII.—THE CHEMISTRY OF A CANDLE.

(Adapted from Dickens's Household Words.)

THE Wilkinsons were having a small party—it consisted of themselves and Uncle Bagges—at which the younger members of the family, home for the holidays, had been just admitted after dinner. Uncle Bagges was a gentleman from whom his affectionate relatives cherished expectations of a testamentary nature. Hence the greatest attention was paid by them to the wishes of Mr. Bagges, as well as to every observation which he might be pleased to make.

"Eh! what? you sir," said Mr. Bagges, facetiously addressing himself to his eldest nephew, Harry—"eh! what? I am glad to hear, sir, that you are doing well at school. Now—eh? now, are you clever enough to tell me where was Moses when he put the candle out?"

"That depends, uncle," answered the young gentleman, "on whether he had lighted the candle to see with at night, or by daylight to seal a letter."

"Eh? Very good, now! 'Pon my word, very good," exclaimed Uncle Bagges. "You must be lord chancellor, sir—lord chancellor, one of these days."

"And now, uncle," asked Harry, who was a favorite with the old gentleman, "can you tell me what you do when you put a candle out?"

"Clap an extinguisher on it, you young rogue, to be sure."

"Oh, but I mean, you cut off its supply of oxygen," said Master Harry.

"Cut off its ox's—eh? what?"

"He means something he heard at the Royal Institution," observed Mrs. Wilkinson. "He reads a great deal about chemistry, and he attended Professor Faraday's lectures there on the chemical history of a candle, and has been full of it ever since."

"Now, you sir," said Uncle Bagges, "come you here to me, and tell me what you have to say about this chemical, eh?—or comical; which?—this—comical chemical history of a candle."

"Harry, don't be troublesome to your uncle," said Mr. Wilkinson.

"Troublesome? Oh, not at all. I like to hear him. Let him teach his old uncle the comicality and chemicality of a farthing rush-light."

"A wax candle will be nicer and cleaner, uncle, and answer the same purpose. There's one on the mantel-shelf. Let me light it."

"Take care you don't burn your fingers, or set any thing on fire," said Mrs. Wilkinson.

"Now, uncle," commenced Harry, having drawn his chair to the side of Mr. Bagges, "we have got our candle burning. What do you see?"

"Let me put on my spectacles," answered the uncle.

"Look down on the top of the candle around the wick. See, it is a little cup full of melted wax. The heat of the flame has melted the wax just round the wick. The cold air keeps the outside of it hard, so as to make the rim of it. The melted wax in the little cup goes up through the wick to be burned, just as oil does in the wick of a lamp. What do you think makes it go up, uncle?"

"Why—why, the flame *draws* it up, doesn't it?"

"Not exactly, uncle. It goes up through little tiny passages in the cotton wick, because very, very small channels, or pipes, or pores, have the power in themselves of sucking up liquids. What they do it by is called cap—something."

"Capillary attraction, Harry," suggested Mr. Wilkinson.

"Yes, that's it; just as a sponge sucks up water, or a bit of lump sugar the little drop of tea or coffee left in the bottom of a cup. Now I'll blow the candle out; not to be in the dark, though, but to see into what it is. Look at the smoke rising from the wick. I'll hold a bit of lighted paper in the smoke, so as not to touch the wick. But see, for all that, the candle lights again. So this shows that the melted wax sucked up through the wick is turned into vapor, and the vapor burns. The heat of the burning vapor keeps on melting more wax, and that is sucked up too within the flame, and turned into vapor and burned, and so on till the wax is all used up and the candle is gone. So the flame, uncle, you see, is the last of the candle, and the candle seems to go through the flame into nothing, although it doesn't, but goes into several things; and isn't it curious, as Professor Faraday said, that the candle should look so splendid and glorious in going away?"

"How well he remembers, doesn't he?" observed Mrs. Wilkinson.

"I dare say," proceeded Harry, "that the flame of the candle looks flat to you; but if we were to put a lamp-glass over it, so as to shelter it from the draught, you would see it is

round—round sideways, and running up to a peak. It is drawn up by the hot air; you know that hot air always rises, and that is the way smoke is taken up the chimney. What should you think was in the middle of the flame?"

"I should say fire," replied Uncle Bagges.

"Oh no. The flame is hollow. The bright flame we see is something no thicker than a thin peel or skin, and it doesn't touch the wick. Inside of it is the vapor I told you of just now. If you put one end of a bent pipe into the middle of the flame, and let the other end of the pipe dip into a bottle, the vapor or gas from the candle will mix with the air there; and if you set fire to the mixture of gas from the candle and air in the bottle, it would go off with a bang."

"I wish you'd do that, Harry," said Master Tom, the younger brother of the juvenile lecturer.

"I want the proper things," answered Harry. "Well, uncle, the flame of the candle is a little shining case, with gas in the inside of it and air on the outside, so that the case of flame is between the air and the gas. The gas keeps going into the flame to burn, and when the candle burns properly none of the gas ever passes out through the flame, and none of the air ever gets in through the flame to the gas. The greatest heat of the candle is in this skin, or peel, or case of flame."

"Case of flame!" repeated Mr. Bagges. "Live and learn. I should have thought a candle-flame was as thick as my poor old noddle."

"I can show you the contrary," said Harry. "I take this piece of white paper, look, and hold it a second or two down upon the candle-flame, keeping the flame very steady. Now I'll rub off the black of the smoke, and—there—you find that the paper is scorched in the shape of a ring, but inside the ring it is only dirtied, and not singed at all."

"Seeing is believing," remarked the uncle.

"But," proceeded Harry, "there is more in the candle-flame than the gas that comes out of the candle. You know a candle won't burn without air. There must be always air around the gas, and touching it like, to make it burn. If a candle hasn't got enough air it goes out, or burns badly, so that some of the vapor inside of the flame comes out through it in the form of smoke, and this is the reason of a candle smoking. So now you know why a great clumsy dip smokes more than a neat wax candle: it is because the thick wick of the dip makes too much fuel in proportion to the air that can get to it."

"Dear me! Well, I suppose there is a reason for every thing," exclaimed the young philosopher's mamma.

"What should you say, now," continued Harry, "if I told you that the smoke that comes out of a candle is the very thing that makes a candle burn with a bright light? Yes; a candle shines by consuming its own smoke. The smoke of a candle is a cloud of small dust; and the little grains of the dust are bits of charcoal, or carbon, as chemists call it. They are burned the moment they are made, and the place they are made in is in the case of flame itself, where the strongest heat is. The great heat separates them from the gas which comes from the melted wax, and, as soon as they touch the air on the outside of the thin case of flame, they burn."

"Can you tell how it is that the little bits of carbon cause the brightness of the flame?" asked Mr. Wilkinson.

"Because they are pieces of solid matter," answered Harry. "To make a flame shine, there must always be some solid—or at least liquid—matter in it."

"Very good," said Mr. Bagges; "solid stuff necessary to brightness."

"Some gases and other things," resumed Harry, "that burn with a flame you can hardly see, burn splendidly when something solid is put into them. Oxygen and hydrogen—tell me if I use too hard words, uncle—oxygen and hydrogen gases, if mixed together and blown through a pipe, burn with plenty of heat, but with very little light. But if their flame is blown upon a piece of quick-lime, it gets so bright as to be quite dazzling. Make the smoke of oil of turpentine pass through the same flame, and it gives the flame a beautiful brightness directly."

"I wonder," observed Uncle Bagges, "what has made you such a bright youth."

"Taking after uncle, perhaps," retorted his nephew. "Don't put my candle and me out. Well, carbon or charcoal is what causes the brightness of all lamps, and candles, and other common lights, so of course there is carbon in what they are all made of."

"So carbon is smoke, eh? and light is owing to your carbon. Giving light out of smoke, eh? as they say in the classics," observed Mr. Bagges.

"But what becomes of the candle," pursued Harry, "as it burns away? where does it go?"

"Nowhere," said his mamma, "I should think. It burns to nothing."

"Oh dear, no!" said Harry; "every thing—every body goes somewhere."

"Eh? rather an important consideration that," Mr. Bagges moralized.

"You can see it goes into smoke, which makes soot for one thing," said Harry. "There are other things it goes into, not to be seen by only looking, but you can get to see them by taking the right means: just put your hand over the candle, uncle."

"Thank you, young gentleman, I would rather be excused."

"Not close enough down to burn you, uncle; higher up. There; you feel a stream of hot air, so something seems to rise from the candle. Suppose you were to put a very long, slender gas-burner over the flame, and let the flame burn just within the end of it, as if it were a chimney, some of the hot steam would go up and come out at the top, but a sort of dew would be left behind in the glass chimney, if the chimney was cold enough when you put it on. There are ways of collecting this sort of dew, and when it is collected it turns out to be really water. I am not joking, uncle. Water is one of the things which the candle turns into in burning—water coming out of fire. In some light-houses, Professor Faraday says, they burn up two gallons of oil in a night; and if the windows are cold, the steam from the oil clouds the inside of the windows, and, in frosty weather, freezes into ice."

"Water out of a candle, eh?" exclaimed Mr. Bagges. "As hard to get, I should have thought, as blood out of a post. Where does it come from?"

"Part from the wax, and part from the air; and yet not a drop of it comes either from the air or the wax. What do you make of that, uncle?"

"Eh? Oh! I'm no hand at riddles. Give it up."

"No riddle at all, uncle. That which comes from the wax is a gas called hydrogen. We can obtain it from water by passing the steam of boiling water through a red-hot gun-barrel which contains a quantity of iron wire or turnings. Part of the steam will mix with the iron turnings, and change them to rust; and the other part, which comes out of the end of the barrel, will be hydrogen gas, and this part of the water we can set on fire."

"Eh?" cried Mr. Bagges. "Upon my word! One of these days we shall have you setting the river on fire."

"Nothing more easy," said Harry. "When pure hydrogen burns, we get nothing but water. I should like to show

you how light this hydrogen is; and I wish I had a small balloon to fill with it and make go up to the ceiling, or a bag-pipe full of it to blow soap-bubbles with, and show how much faster they rise than common ones blown with the breath."

"So do I," interposed Master Tom.

"And so," resumed Harry, "hydrogen, you know, uncle, is part of water, and just one ninth part."

"As hydrogen is to water, so is a tailor to an ordinary individual, eh?" Mr. Bagges remarked.

"Well, now, then, uncle, if hydrogen is the tailor's part of the water, what are the other parts?"

"There must be eight of them, to be sure."

"Good again, uncle; and these eight parts are a gas also, that is called oxygen. This is a very curious gas. It won't burn in air at all itself, like gas from a lamp, but it has a wonderful power of making things burn that are lighted and put into it. A lighted candle put into a jar of oxygen blazes up directly, and is consumed before you can say Jack Robinson. Charcoal burns away in it as fast, with beautiful bright sparks; phosphorus with a light that dazzles you to look at; and a piece of iron or steel, just made red-hot at the end first, is burned in oxygen quicker than a stick would be in common air. The experiment of burning things in oxygen beats any fire-works."

"How funny that must be!" exclaimed Tom.

"Now we see, uncle," Harry continued, "that water is hydrogen and oxygen united together; that water is got wherever hydrogen is burned in common air; that a candle won't burn without air; and that, when a candle burns, there is hydrogen in it burning and forming water. Now, then, where does the hydrogen of the candle get the oxygen from to turn into water with it?"

"From the air, eh?"

"Just so. It is the oxygen in the air that makes things burn; but if the air were nothing but oxygen, a candle would not last above a minute."

"What a tallow-chandler's bill we should have!" remarked Mrs. Wilkinson.

"If a house were on fire in oxygen," as Professor Faraday said, "every iron bar, or, rather, every pillar, every nail and iron tool, and the fireplace itself; all the zinc and copper roofs, and leaden coverings, and gutters, and pipes, would consume and burn, increasing the combustion."

"That would be, indeed, burning 'like a house on fire,'" observed Mr. Bagges.

"But there is another gas, called nitrogen," said Harry, "which is mixed with the air, and it is this which prevents a candle from burning out too fast."

"Eh?" said Mr. Bagges. "Well, I will say I do think we are under considerable obligations to nitrogen."

"I have explained to you, uncle," pursued Harry, "how a candle, in burning, turns into water. But it turns into something else besides that. The little bits of carbon that I told you about, which are burned in the flame of a candle, and which make the flame bright, mingle with the oxygen in burning, and form still another gas, called carbonic acid gas, which is so destructive of life when we breathe it. So you see that a candle-flame is vapor burning, and that the vapor, in burning, turns into water and carbonic acid gas."

"Haven't you pretty nearly come to your candle's end'?" said Mr. Wilkinson.

"Nearly. I only want to tell uncle that the burning of a candle is almost exactly like our breathing. Breathing is consuming oxygen, only not so fast as burning. In breathing, we throw out water in vapor and carbonic acid from our lungs, and take oxygen in. Oxygen is as necessary to support the life of the body as it is to keep up the flame of a candle."

"So," said Mr. Bagges, "man is a candle, eh? and Shakespeare knew that, I suppose (as he did most things), when he wrote,

'Out, out, brief candle!'

Well, well; we old ones are moulds, and you young squires are dips and rush-lights, eh? Any more to tell us about the candle?"

"I could tell you a great deal more about oxygen, and hydrogen, and carbon, and water, and breathing, that Professor Faraday said, if I had time; but you should go and hear him yourself, uncle."

"Eh? well, I think I will. Some of us seniors may learn something from a juvenile lecture, at any rate, if given by a Faraday. And now, my boy, I will tell you what," added Mr. Bagges, "I am very glad to find you so fond of study and science; and you deserve to be encouraged; and so I'll give you a—what-d'ye-call-it? a galvanic battery on your next birthday; and so much for your teaching your old uncle the chemistry of a candle."

LESSON XIII.—THE POETIC REALITIES OF NATURE.

From HUNT's *Poetry of Science*.

1. THE animated marble of ancient story is far less wonderful than the fact, proved by investigation, that every atom of matter is interpenetrated by a principle which directs its movements and orders its positions, and involved by an influence which extends without limits to all other atoms, and which determines their union or otherwise.

2. We have gravitation drawing all matter to a common centre, and acting from all bodies throughout the wide regions of unmeasured space upon all. We have cohesion holding the particles of matter enchained, operating only at distances too minute for the mathematician to measure; and we have chemical attraction, different from either of these, working no less mysteriously within absolutely insensible distances, and by the exercise of its occult power giving determinate and fixed forms to every kind of material creation.

3. The spiritual beings which the poet of untutored nature gave to the forest, to the valley, and to the mountain, to the lake, to the river, and to the ocean, working within their secret offices, and moulding for man the beautiful or the sublime, are but the weak creations of a finite mind, although they have for us a charm which all men unconsciously obey, even when they refuse to confess it. They are like the result of the labors of the statuary, who, in his high dreams of love and sublimated beauty, creates from the marble rock a figure of the most exquisite moulding which mimics life. It charms us for a season; we gaze and gaze again, and its first charms vanish; it is ever and ever still the same dead heap of chiseled stone. It has not the power of presenting to our wearying eyes the change which life alone enables matter to give; and, while we admit the excellence of the artist, we cease to feel at his work.

4. The mysteries of flowers have ever been the charm of the poet's song. Imagination has invested them with a magic influence, and fancy has almost regarded them as spiritual things. In contemplating their surpassing loveliness, the mind of every observer is improved, and the sentiments which they inspire, by their mere external elegance, are great and good. But on examining the real mysteries of their conditions, their physical phenomena, the relations in which they stand to the animal world, "stealing and giving odors" in

the marvelous interchange of carbonic acid and ammonia for the soul-inspiring oxygen—all speaking of the powers of some unseen, indwelling principle, directed by a supreme ruler—the philosopher finds subjects for deep and soul-trying contemplation. Such studies lift the mind into the truly sublime of nature. The poet's dream is the dim reflection of a distant star; the philosopher's revelation is a strong telescopic examination of its features. One is the mere echo of the remote whisper of Nature's voice in the dim twilight; the other is the swelling music of the harp of Memnon,¹ awakened by the sun of truth, newly risen from the night of ignorance.

5. Poetical *creations* are pleasing, but they never affect the mind in the way in which the poetic *realities* of nature do. The sylph moistening a lily is a sweet dream; but the thoughts which rise when first we learn that the broad and beautiful dark green leaves of the lily, and its pure and delicate flower, are the results of the alchemy which changes gross particles of matter into symmetric forms, of a power which is unceasingly at work under the guidance of light, heat, and electrical force, are, after our incredulity has passed away—for it is too wonderful for the untutored to believe at once—of an exalting character.

6. The flower has grown under the impulse of principles which have been borne to it on the beam of solar light, and mingled with its substance, and it has a language for all men. The poet, indeed, tells us of a man to whom

“The primrose on the river's brink
A yellow primrose was to him,
And it was nothing more.”

But it *was* something more. He perhaps attended not to the eloquent teaching of its pure pale leaves; he might not have been conscious of the mysterious singing of that lowly flower; he might perchance have crushed it beneath his rude foot rather than quaff the draught of wisdom which it secreted in its cell; but the flower still ministered to that mere sensualist, and in its strange tongueless manner reproved his passions, and kept him “a wiser and a better man” than if it had pleased God to leave the world without the lovely primrose.

7. A stone, likewise, is merely a stone to most men. But within the interstices² of the stone, and involving it like an atmosphere, are great and mighty influences—powers which are fearful in their grander operations, and wonderful in their gentler developments. The stone and the flower hold, locked up in their recesses, the three great known forces, light, heat, and electricity, and, in all probability, others of a more

exalted nature still, to which these powers are but subordinate agents. Such are the facts of science, which, indeed, draw "sermons from stones," and find "tongues in trees." Science alone can interpret the mysterious whisperings of Nature, *and in this consists its poetry.*

8. How weak are the creations of romance when viewed beside the discoveries of science. One affords matter for meditation, and gives rise to thoughts of a most ennobling character; the other excites for a moment, and leaves the mind vacant or diseased. The former, like the atmosphere, furnishes a constant supply of the most healthful matter; the latter gives an unnatural stimulus, which compels a renewal of the same kind of excitement to maintain the continuation of its pleasurable sensations.

¹ MEM'-NON. The famous vocal statue of Memnon, in Egypt, was said to utter, when it was struck by the first beams of the rising sun, a sound like the snapping asunder of a musical string; an historical fact, but the cause of which remains a mystery.

² IN'-TER-STI-CES, spaces between the parts which compose a body.

LESSON XIV.—THE EXTENT OF CHEMICAL ACTION.

ROBERT HUNT.

1. It is evident that in all chemical phenomena we have the combined exercise of the great physical forces and evidences of some powers which are, as yet, shrouded in the mystery of our ignorance. The formation of minerals within the clefts of the rocks, the germination of seeds, the growth of the plant, the developments of its fruit and its ultimate decay, the secret processes of animal life, assimilation, digestion, and respiration, and all the changes of external form which take place around us, are the result of the exercise of that principle which we call chemical.

2. By chemical action plants take from the atmosphere the elements of their growth; these they yield to animals, and from these they are again returned to the air. The viewless atmosphere is gradually formed into an organized being, which as gradually is again resolved into the thin air, and all through chemical processes. The changes of the mineral world are of an analogous character, but we can not trace them so clearly in all their phenomena.

3. An eternal round of chemical action is displayed in nature. Life and death are but two phases of its influences. Growth and decay are equally the result of its power.

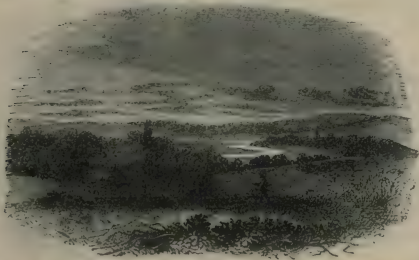
NINTH MISCELLANEOUS DIVISION.

ELEGY WRITTEN IN A COUNTRY CHURCH-YARD.—THOS. GRAY.

["Gray's Elegy" is generally conceded to be one of the most finished poems ever written. It supposes the poet to be musing in a country church-yard at the close of a tranquil summer's day, when the scene calls up a train of reflections upon the character and occupations of the "rude forefathers of the peaceful hamlet" who sleep beneath him. Reflecting that they shall wake no more at morn to pursue their daily avocations, he passes in review before him the industrious, contented, unambitious life they led, while both their virtues and their crimes were circumscribed by the humble lot in life which Providence had assigned them. The poet then fancies some one, after years had passed away, inquiring into *his* fate, and he puts into the mouth of "some hoary-headed swain" a simple relation of the little that might then be told of his, the poet's, humble history; and this is followed, in the last three verses, by his own epitaph. The artist has pictured every scene described, as it is supposed to have arisen in the mind of the poet.]



1. THE curfew tolls the knell of parting day;
The lowing herd winds slowly o'er the lea;
The plowman homeward plods his weary way,
And leaves the world to darkness and to me.



2. Now fades the glimmering landscape on the sight,
And all the air a solemn stillness holds,
Save where the beetle wheels his droning flight,
And drowsy tinklings lull the distant folds:



3. Save that, from yonder ivy-mantled tower,
The moping owl does to the moon complain
Of such as, wandering near her secret bower,
Molest her ancient solitary reign.



4. Beneath those rugged elms, that yew-tree's shade,
Where heaves the turf in many a mouldering heap,
Each in his narrow cell forever laid,
The rude forefathers of the hamlet sleep.



5. The breezy call of incense-breathing morn,
The swallow twittering from the straw-built shed,
The cock's shrill clarion, or the echoing horn,
No more shall rouse them from their lowly bed.



6. For them, no more the blazing hearth shall burn,
 Or busy housewife ply her evening care;
 No children run to lisp their sire's return,
 Or climb his knees, the envied kiss to share.



- 7 Oft did the harvest to their sickle yield;
 Their furrow oft the stubborn glebe has broke;
 How jocund did they drive their team a-field!
 How bow'd the woods beneath their sturdy stroke!



8. Let not Ambition mock their useful toil,
 Their homely joys, and destiny obscure;
 Nor Grandeur hear, with a disdainful smile,
 The short and simple annals of the poor.



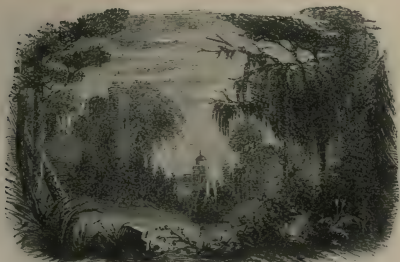
9. The boast of heraldry, the pomp of power,
And all that beauty, all that wealth e'er gave,
Await, alike, th' inevitable hour—
The paths of glory lead but to the grave.



10. Nor you, ye proud! impute to these the fault,
If Memory o'er their tomb no trophies raise;
Where, through the long-drawn aisle and fretted vault,
The pealing anthem swells the note of praise.



11. Can storied urn, or animated bust,
Back to its mansion call the fleeting breath?
Can Honor's voice provoke the silent dust?
Or Flattery soothe the dull, cold ear of Death?



12. Perhaps, in this neglected spot, is laid
 Some heart, once pregnant with celestial fire;
 Hands that the rod of empire might have sway'd,
 Or waked to ecstasy the living lyre.



13. But Knowledge, to their eyes, her ample page,
 Rich with the spoils of time, did ne'er unroll:
 Chill Penury repressed their noble rage,
 And froze the genial current of the soul.



14. Full many a gem of purest ray serene,
 The dark, unfathom'd caves of ocean bear;
 Full many a flower is born to blush unseen,
 And waste its sweetness on the desert air.



15. Some village Hampden, that, with dauntless breast,
 The little tyrant of his fields withstood;
 Some mute, inglorious Milton here may rest;
 Some Cromwell, guiltless of his country's blood.



16. Th' applause of listening senates to command;
 The threats of pain and ruin to despise;
 To scatter plenty o'er a smiling land,
 And read their history in a nation's eyes,



17. Their lot forbad: nor circumscribed alone
 Their growing virtues, but their crimes confined;
 Forbad to wade through slaughter to a throne.
 And shut the gates of mercy on mankind.



18. The struggling pangs of conscious truth to hide;
To quench the blushes of ingenuous shame;
Or heap the shrine of Luxury and Pride,
With incense kindled at the Muse's flame.



19. Far from the madding crowd's ignoble strife,
Their sober wishes never learn'd to stray;
Along the cool, sequester'd vale of life,
They kept the noiseless tenor of their way.



20. Yet e'en these bones from insult to protect,
Some frail memorial still, erected nigh,
With uncouth rhymes and shapeless sculpture deck'd,
Implores the passing tribute of a sigh.



21. Their name, their years, spelt by th' unletter'd Muse,
 The place of fame and elegy supply ;
 And many a holy text around she strews,
 That teach the rustic moralist to die.



22. For who, to dumb Forgetfulness a prey,
 This pleasing, anxious being e'er resigned ;
 Left the warm precincts of the cheerful day,
 Nor cast one longing, lingering look behind ?



23. On some fond breast the parting soul relies ;
 Some pious drops the closing eye requires ;
 E'en from the tomb the voice of Nature cries ;
 E'en in our ashes live their wonted fires.



24. For thee, who, mindful of th' unhonor'd dead,
Dost in these lines their artless tale relate;
If 'chance, by lonely Contemplation led,
Some kindred spirit shall inquire *thy* fate;



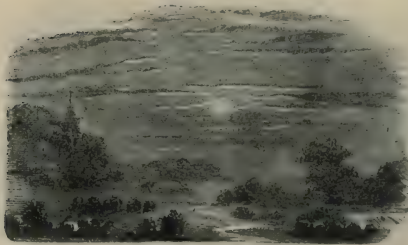
25. Haply, some hoary-headed swain may say:
"Oft have we seen him, at the peep of dawn,
Brushing, with hasty steps, the dews away,
To meet the sun upon the upland lawn.



26. "There, at the foot of yonder nodding beech,
That wreathes its old fantastic roots so high,
His listless length, at noontide, would he stretch,
And pore upon the brook that babbles by.



27. "Hard by yon wood, now smiling, as in scorn,
Muttering his wayward fancies, he would rove :
Now drooping, woeful, wan, like one forlorn,
Or crazed with care, or cross'd in hopeless love.



28. "One morn I miss'd him on the 'custom'd hill,
Along the heath, and near his favorite tree ;
Another came—nor yet beside the rill,
Nor up the lawn, nor at the wood was he ;



29. "The next, with dirges due, in sad array,
Slow through the church-way path we saw him borne.
Approach and read (for thou canst read) the lay
Graved on the stone beneath you aged thorn."



30. Here rests his head upon the lap of Earth,
 A youth, to fortune and to fame unknown,
 Fair Science frown'd not on his humble birth,
 And Melancholy mark'd him for her own.



31. Large was his bounty, and his soul sincere;
 Heaven did a recompense as largely send:
 He gave to Misery all he had—a tear;
 He gain'd from Heaven ('twas all he wish'd) a friend.



32. No farther seek his merits to disclose,
 Or draw his frailties from their dread abode,
 (There they alike in trembling hope repose),
 The bosom of his Father and his God.

THE RAZOR-SELLER.

The following is a fine reading exercise, and pains should be taken to give it the same degree of *naturalness* that we should expect if the original scene had been acted before our eyes.

1. A fellow in a market town,
Most musical, cried razors up and down,
And offered twelve for eighteen pence,
Which certainly seemed wondrous cheap,
And for the money quite a heap,
As every man would buy, with cash and sense.
2. A country bumpkin the great offer heard—
Poor Hodge, who suffered by a broad black beard,
That seemed a shoe-brush stuck beneath his nose—
With cheerfulness the eighteen pence he paid,
And proudly to himself, in whispers, said,
"This rascal *stole* the razors, I suppose'.
3. "No matter if the fellow *be* a knave,
Provided that the razors *shave*;
It certainly will be a monstrous prize."
So home the clown, with his good fortune, went,
Smiling in heart and soul, content,
And quickly soap'd himself to ears and eyes.
4. Being well lathered from a dish or tub,
Hodge now began with grinning pain to grub,
Just like a hedger cutting furze :
'Twas a vile razor!—then the rest he tried—
All were impostors—"Ah!" Hodge sigh'd,
"I wish my eighteen pence within my purse."
5. Hodge sought the fellow—found him—and begun :
"P'rhaps, Master Razor-rogue', to you 'tis *fun*,
That people flay themselves out of their lives' :
You rascal! for an hour have I been grubbing,
Giving my crying whiskers here a scrubbing,
With razors just like oyster' knives.
Sirrah! I tell you, you're a knave',
To cry up razors that can't *shave*."
6. "Friend," quoth the razor-man, "I'm *not* a knave :
As for the *razors* you have bought',
Upon my soul' I never thought'
That they would *shave*."
"Not think they'd *shave*!" quoth Hodge, with wondering eyes,
And voice not much unlike an Indian yell ;
"What were they made for, then, you dog?" he cries :
"Made'!" quoth the fellow, with a smile—"TO SELL'."
JOHN WOLCOTT (PETER PINDAR).

PART X.

FIRST DIVISION OF GEOLOGY.

[This subject is continued in the Sixth Reader.]



The "Medals of Creation."

Behold! a new kind of medals, much more important and incomparably more ancient than those of the Greeks and the Romans.—KNORR'S *Monuments*.

LESSON I.—INTRODUCTORY.

1. It is from the "Medals of Creation"—the fossil remains of plants and animals scattered throughout the rocky strata of the globe—that we are enabled to read that wonderful portion of our earth's history which reaches back even into chaos itself, myriads of ages before the creation of man. These are the *electrotypes of nature*—faithful records, which there is no conflicting testimony to invalidate, and which no criticism can gainsay.

2. It is believed by most geologists that the earth was at one time a molten mass, surrounded by an atmosphere filled with dense gases and vapors; and that, as the outer portions cooled, forming the rocks and the dry land, the vapors, condensing and falling in showers, formed springs, rivers, and the waters of the ocean. This is the geological theory of the gradual calling of order out of chaos, after the great work of creation had been completed.

3. It is maintained that this view of the early condition of our globe, and of the successive changes that subsequently occurred in it during thousands and perhaps millions of years prior to the creation of man, does not at all conflict with the scriptural account of the creation. The scriptural account,

as paraphrased by a modern commentator, would read thus: "In the *beginning* God created the heavens and the earth. And the earth was desolate. *Afterward*, the Spirit of God moved upon the face of the waters;" thus allowing the possibility of even millions of years between the first act of creative power and the six days' work of arranging the universe.

4. Different opinions long prevailed among the learned with regard to the nature, the extent of time, and the date of the six days' work of creation, for the Bible gives us no explanation on these points; but by most of the learned of the present day, and by all eminent geologists, the "six days" are understood to be indefinite periods of time, as it is said that, with the Almighty, "a thousand years are to be reckoned but as one day." It seems reasonable to suppose that they may have been prophetic periods looking into the past, and seen in vision by the inspired historian. "The Creation" has been chosen as a theme for august description by the poet Milton, and it likewise forms the subject of Haydn's grandest oratorio.

LESSON II.—RAPHAEL'S ACCOUNT OF THE CREATION.

MILTON.

1. HEAVEN opened wide
Her ever-during gates—harmonious sound—
On golden hinges moving, to let forth
The King of Glory, in his powerful Word
And Spirit coming to create new worlds.
On heavenly ground they stood; and, from the shore,
They viewed the vast, immeasurable abyss,
Outrageous as a sea, dark, wasteful, wild,
Up from the bottom turned by furious winds
And surging waves, as mountains to assault
Heaven's height, and with the centre mix the pole.
2. "Silence, ye troubled waves, and thou deep, peace!"
Said then the omnific Word; "your discord end!"
Nor stayed, but, on the wings of cherubim
Uplifted, in paternal glory rode
Far into chaos, and the world unborn;
For chaos heard his voice: him all his train
Followed in bright procession, to behold
Creation, and the wonders of his might.
3. Then stayed the fervid wheels, and in his hand
He took the golden compasses, prepared
In God's eternal store, to circumscribe
This universe, and all created things:
One foot he centred, and the other turned
Round through the vast profundity obscure,

And said, "Thus far extend, thus far thy bounds,
This be thy just circumference, oh world!"

4. Thus God the heaven created, thus the earth,
Matter unformed and void; darkness profound
Covered the abyss; but on the watery calm
His brooding wings the Spirit of God outspread,
And vital virtue infused, and vital warmth
Throughout the fluid mass:
———— then founded, then conglobed
Like things to like, the rest to several place
Disparted, and between spun out the air;
And earth, self-balanced, on her centre hung.
5. "Let there be light," said God; and forthwith light
Ethereal, first of things, quintessence pure,
Sprung from the deep, and, from her native east,
To journey through the airy gloom began,
Sphered in a radiant cloud; for yet the sun
Was not: she in a cloudy tabernacle
Sojourned the while. God saw the light was good,
And light from darkness, by the hemisphere,
Divided: light the day, and darkness night,
He named.
6. Thus was the first day, even and morn:
Nor passed uncelebrated, nor unsung
By the celestial choirs, when orient light
Exhaling first from darkness they beheld;
Birthday of heaven and earth: with joy and shout
The hollow universal orb they filled,
And touched their golden harps, and, hymning, praised
God and his works: Creator him they sung,
Both when first evening was, and when first morn.

LESSON III.—CHARACTER OF THE GEOLOGICAL HISTORY OF THE EARTH.

1. GEOLOGY is the science which treats of the materials that compose the earth, and of the organic remains which they contain. According to Sir Charles Lyell, "Geology is the science which investigates the successive changes that have taken place in the organic and inorganic kingdoms of nature; it inquires into the causes of these changes, and the influences which they have exerted in modifying the surface and external structure of our planet."

2. The earth has not always existed in its present condition, and geology gives us a view of its history during a period of unknown length—not *only* thousands, but perhaps millions of years—long before the creation of man. It appears that, during this time, the earth underwent many

changes ; that beds or strata of rock were formed during successive ages at the bottom of the seas by the gradual wearing away of rocks on land, through atmospheric agencies and the action of water, and their deposition on the bed of the ocean in the form of mud, and sand, and gravel ; that these strata were sometimes thrown up by subterranean forces ; and that hills and valleys were thus formed, and the sea and land often made to change places. But what is more wonderful than all this, and that which gives the study of geology peculiar interest, we have abundant proof that while these operations were going on, there arose a succession of plants and animals, beginning with those of simplest form, often widely different from any now in existence, and advancing to those of higher character, until those nearest the present races appeared.

3. All this wonderful history has been learned in the following manner. From the present appearances of mountain chains, and chasms, and from artificial excavations, geologists have been enabled, after an almost incredible amount of labor and research, directed by the light of science, to rearrange, measure, and examine the different formations called *stratified* rocks, which are supposed to reach, when unbroken, to the depth of about ten miles below the surface ; below which, and of an unknown depth, are the *unstratified* masses, which show from their position, and the crystalline arrangement of their parts, the action of heat, and an origin earlier in point of time. All but the lower or first formed class of the stratified rocks are found to contain the remains of plants and animals, generally in a fossil state, nearly all of which (except those in the very uppermost strata), to the number of more than thirty thousand species, were different from any that now exist.

4. It is surprising how much may be learned of the structure and habits of animals from a few fossil remains. It is stated that, so mathematically exact are the proportions between the different parts of an animal, "from the character of a single limb, and even of a single tooth or bone, the forms and proportions of the other bones, and the condition of the entire animal, may be inferred. Hence, not only the frame-work of the fossil skeleton of an extinct animal, but also the character of the muscles by which each bone was moved, the external form and figure of the body, the food, and habits, and haunts, and mode of life of creatures that ceased to exist before the creation of the human race, can, with a high degree of probability, be ascertained."

5. Sometimes organic remains, such as bones, are found but partially decayed, and sometimes impregnated with mineral matter; sometimes, through chemical changes, the animal or vegetable matter has entirely disappeared, and the place which it occupied, in what has since become rock, has been so entirely filled with mineral matter as to form a genuine *petrification*; sometimes, after the rock had become hardened, the animal or plant had decayed and escaped through the pores of the stone, so as to leave nothing but a perfect *mould*; while at other times the only evidence of the existence of an animal is its track in the clay or sand, since hardened into rock.

6. When Shakspeare made his charming Ariel sing

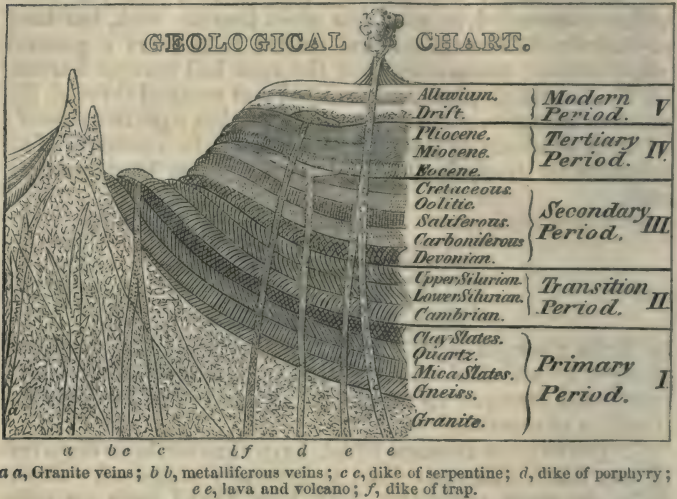
"Full fathom five thy father lies,
Of his bones are coral made,
Those are pearls that were his eyes;
Nothing of him that doth fade
But doth suffer a sea change
Into something rich and strange,"

he little thought how correctly he painted the chemical changes by which, during the ages past, decomposing animal matter has stamped its myriad forms upon what are now the "medals of creation."

7. The organic remains which have thus far been discovered are more abundant than is generally supposed. Fossil shells, in great quantities, have been found both on lofty mountains and below the beds of rivers. On mountains and in mines, hundreds of miles from the sea, are the remains of strange-looking fish; the skeleton of a whale has been found on a mountain three thousand feet high, and the skeleton of an elephant has been exhumed from the frozen sand and mud on the very confines of the Frozen Sea. But, what is more wonderful still, whole mountains, hundreds and even thousands of feet high, are essentially composed of organic remains.

8. Such is the character of the language which the geologist must learn before he can read the curious history of the earth, and of the animal and vegetable races that have lived upon it. A very accurate and extensive knowledge of zoology and botany will also be required, to enable him to ascertain whether the organic remains which he finds in the rocks belonged to extinct species, or are identical with those now living on the globe. That part of geology which gives the history of the remains of plants and animals is called *Paleontology*, a Greek word which means "the science of ancient beings or creatures."

THE DIFFERENT PERIODS OF THE EARTH'S HISTORY.



The above cut, designed to give a geological view of the earth's history, represents a vertical section of the earth, with the several classes of stratified formations resting upon the unstratified granite rocks, the latter being represented here as thrown up through the superincumbent mass by volcanic agency. By this tilting up of the stratified rocks in numerous localities, so that the edges of even the lowermost of the strata may be seen, both the relative position and the thickness of all the strata have been very accurately ascertained.

LESSON IV.—THE PRIMARY PERIOD.

"Oh, who can strive
To comprehend the vast, the awful truth
Of the eternity that hath gone by,
And not recoil from the dismayed sense
Of human impotence! The life of man
Is summed in birthdays and in sepulchres,
But the eternal God had no beginning."

1. The geological history of our globe, as gathered from its structure, begins far back—myriads of years beyond our powers of computation, but even then far removed from "the beginning"—in some unknown age of sterility and desolation. If plants and animals then existed, all traces of them were subsequently destroyed by a period of intense heat, which fused the earth's surface into a molten mass, and formed a vast layer, of unknown depth, of what are called the primary or unstratified rocks, of which the enduring granite, the low-

est in the series, and the great frame-work of the earth's crust, is the most abundant.*

2. It is granite rock chiefly which is now seen rising to the greatest heights, and stretching into those mountain chains which form the grand natural divisions of the globe. In these cases the granite has been thrown up by subterranean forces, breaking through the superincumbent strata, tilting them up on their edges, and thus affording to the geologist the opportunity of examining them in detail.† It is chiefly in veins of the primary rocks that the ores of lead, tin, and the precious metals are found. The celebrated geologist Hugh Miller, in speaking of this primary period of the world's history, in which he supposes that the earth's crust had sufficiently cooled down to permit the existence of a sea, with waves and currents, draws the following imaginary picture:

3. "I dare not speak of the scenery of the period. We may imagine, however, a dark atmosphere of steam and vapor, which, age after age, conceals the face of the sun, and through which the light of moon or star never penetrates; oceans of thermal water, heated in a thousand centres to the boiling point; low, half-molten islands, dim through the fog, and scarce more fixed than the waves themselves, that heave and tremble under the impulsions of the igneous agencies; roaring geysers, that ever and anon throw up their intermittent jets of boiling fluid, vapor, and thick steam, from these tremulous lands; and, in the dim outskirts of the scene, the red gleam of fire, shot forth from yawning cracks and deep chasms, and bearing aloft fragments of molten rock and clouds of ashes. But, should we continue to linger amid a scene so featureless and wild, or venture adown some yawning opening into the abyss beneath, where all is fiery and yet dark—a solitary hell, without suffering or sin—we would do well to commit ourselves to the guidance of a living poet, and see with his eyes, and describe in his verse:

4. The awful walls of shadows round might dusky mountains seem,
But never holy light hath touched an outline with its gleam;
'Tis but the eye's bewildered sense that fain would rest on form,
And make night's thick blind presence to created shapes conform.
No stone is moved on mountain here by creeping creature crossed,
No lonely harper comes to harp upon this fiery coast:
Here all is solemn idleness; no music here, no jars,
Where silence guards the coast ere thrill her everlasting bars;
No sun here shines on wanton isles; but o'er the burning sheet
A rim of restless halo shakes, which marks the internal heat;
As in the days of beauteous earth we see, with dazzled sight,
The red and setting sun o'erflow with rings of welling light.—THOMAS AIRD.

* Granite is composed chiefly of mica, quartz, and feldspar; but in some granite rocks talc and hornblende take the place of mica, and then the rock is called *sienite*. *Porphyry* is only another modification of granite.

† See cut at the head of this lesson.

LESSON V.—THE TRANSITION PERIOD.



GEOLOGICAL REMAINS OF ANIMALS OF THE TRANSITION PERIOD.

1, 6, and 8 are Coral Zoophytes of the Lower Silurian. 2, 10, and 12 are Lower Silurian Trilobites, from one to three inches in length. 3, 4, and 5 are the earliest Molluscs or Shell-fish. 7, a Silurian Crinoidea—an animal having a radiated lily-shaped disk supported on a jointed stem. 9, a Placoid Fish of the Upper Silurian. 13 and 15 are Ammonites; and 14, a section of No. 13, showing the interior chambers. 16, a Star-fish. 17, one of the earliest Polypes, or plant-like Zoophytes.

1. In entering upon the second age of the world's history, which is called the *transition* period, the evidences of stratification, which began to be dimly discerned in the uppermost of the primary rocks, are quite decisive, and layer follows upon layer, mostly of a slaty character, until the mass accumulates to the supposed average depth of five or six miles. All of these layers appear to have been gradually deposited at the bottom of the ocean during myriads of years by the slow wearing away of the mountains of the primary rocks by the action of water.

2. In this transition period, of incalculable vastness, we discern, in a few scattered fossils, the first faint traces of the beginnings of vegetable and animal life. In the lower, or Cambrian portion, a few sea-weeds have left their imprints in the rocks; and a few shells and corals, and a few trilobites—most singular species of Crustaceans—have been transformed into stone. In the upper, or Silurian portions, sea-weeds are more numerous, and the fragmentary remains of a few terrestrial vegetables are discernible; but marine shells and corals abound, and the trilobites receive their fullest development, both in size and number. Here a few fishes first appear, of the Placoid order, as perfect in their kind as those of later ages, but their forms are not well known. In this period, myriads of ages ago, life appeared in fashions pecul-

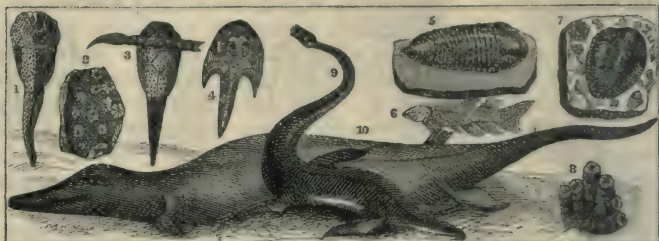
ially antique, and nearly all of its types have long since become obsolete.

3. It is, however, interesting to notice here that shells of the family called *Ammonites*, which are among the earliest traces of the animal kingdom, appear in this early period; and it is a curious fact, that while all other families and orders of shells of this period—and, indeed, of many subsequent eras—have entirely died out, and now form vast layers of rocky strata of limestone and marble, some species allied to the ancient family of the *Ammonites* are found in every succeeding period of geological history, and kindred species exist in our seas at the present day. Among these is the *Nautilus*, whose geological history has been written in the following appropriate lines:

4. Thou didst laugh at sun and breeze
 In the new created seas;
 Thou wast with the reptile broods
 In the old sea solitudes,
 Sailing in the new-made light
 With the curled-up ammonite.
 Thou surviv'dst the awful shock
 Which turned the ocean bed to rock,
 And changed its myriad living swarms
 To the marble's veined forms.
5. Thou wast there, thy little boat,
 Airy voyager, kept afloat
 O'er the waters wild and dismal,
 O'er the yawning gulfs abysmal;
 Amid wreck and overturning,
 Rock-imbedding, heaving, burning.
 Mid the tumult and the stir,
 Thou, most ancient mariner,
 In that pearly boat of thine,
 Sail'dst upon the troubled brine.—MRS. HOWITT.

6. It should be remarked that thus far in the world's history no traces of any reptile, bird, or mammal have been discovered, which may be considered evidence conclusive that none of these animals were in existence at this epoch; but when, at length, after countless ages, fishes appeared, *perfect in their kind*, at the same time are presented the first evidences of a diminutive, yet highly organized tree vegetation. Vertebrated animals and land vegetation were new and distinct creations; and upward, from life's beginnings, through all its ascending stages, we constantly meet with evidences of new creations, but none whatever of any *development* of higher grades from lower. The first fiat of creation doubtless insured the perfect adaptation of animals to the surrounding media; and thus, while the geologist recognizes a beginning, he sees the same evidences of Omniscience in the lower Crustaceans as in the completion of the higher Vertebrate form.

LESSON VI.—THE SECONDARY PERIOD.



GEOLOGICAL REMAINS OF ANIMALS OF THE MIDDLE SECONDARY PERIOD.

1, 3, and 4, remains of curious Fish, from six to ten inches in length. 6, a Ganoid Fish. 2 and 8, fossil Corals. 5 and 7, Trilobites, five or six inches in length. 9, the Plesiosaurus, a lizard-like marine reptile, from ten to fifteen feet in length. 10, the Ichthyosaurus, or fish-lizard, a kind of reptile whale, from twenty to thirty feet in length. [The relative proportions could not be preserved in the drawing.]

1. In ascending from the Transition to the Secondary period, after passing the Devonian, which in North America exhibits no less than eleven distinct eras, we arrive at the Carboniferous system of rocks, which is so called from being the great depository of that important substance called coal. A new creation is here opened to view in the luxuriant tropical vegetation which distinguishes the Carboniferous epoch of our globe. The various kinds of coal are simply vegetable matter—the remains of ancient forests deposited in vast ravines or ocean beds, and deeply buried there, and changed to their present forms by chemical processes in Nature's own laboratory.* The coal is often covered by layers of shale, or slaty coal, which consists of masses of leaves and stems closely pressed together, and indicating an intermediate stage in the coal formation. The appearance of the roof of one of the coal-mines of Bohemia having this shale or partially formed coal for its covering, is thus described by Dr. Buckland:

2. "The most elaborate imitations of living foliage on the painted ceilings of the Italian palaces bear no comparison with the beauteous profusion of extinct vegetable forms with which the galleries of these instructive coal-mines are overhung. The roof is covered as with a canopy of gorgeous tapestry, enriched with festoons of most graceful foliage, flung

* This seems to have been effected by exposure to heat and moisture, probably under great pressure, and in circumstances that excluded the air, and prevented the escape of the more volatile principles. Not only the various coals, but bitumen, amber, mineral oils, and even the diamond, were probably produced under various modifications of these circumstances.

in wild, irregular profusion over every portion of its surface. The effect is heightened by the contrast of the coal-black color of these vegetables with the light groundwork of the rock to which they are attached.

3. "The spectator feels transported, as if by enchantment, into the forests of another world; he beholds trees of form and character now unknown upon the surface of the earth, presented to his senses almost in the beauty and vigor of their primeval life; their scaly stems and bending branches, with their delicate apparatus of foliage, are all spread forth before him, little impaired by the lapse of indefinite ages, and bearing faithful records of extinct systems of vegetation, which began and terminated in times of which these relics are the infallible historians. Such are the grand natural herbaria wherein these most ancient remains of the vegetable kingdom are preserved in a state of integrity little short of their living perfection, under conditions of our planet which exist no more."

4. It is not only known that coal is of vegetable origin, but the kinds of plants which formed it have been accurately determined, to the number of more than three hundred species, but all different from any of the present age, although allied to existing types by common principles of organization. Of these fossil species, two thirds are related to the tree ferns and the higher orders of cryptogamous plants. The coniferous, or cone-bearing species, are also prominent; and there is little doubt that petroleum, and naphtha, and other mineral oils of coal regions, are nothing more than the turpentine oil of the pines of former ages. The internal heat of the earth has distilled it; and, after being buried for thousands of years, it is now discovered, to supply the wants of man. Remains of corals, shell-fish, a few insects, among which are several species of beetle, fishes of peculiar construction, the king-crab among Crustaceans, and in Pennsylvania the tracks of some Batrachian reptiles, have been found in the Carboniferous rocks. Here, also, are the last of the trilobites, which appear to have become extinct after the coal formations.

5. Ascending above the Carboniferous epoch, we pass successively, in this Secondary period, through three groups or systems of rocky strata, known as the Saliferous, or Red Sandstone, the Oolitic, and the Cretaceous. The first of these is comparatively scanty in organic remains; but in the other two, fossils are exceedingly abundant. Our existing islands and continents are principally composed of the spoils of this

period, whose history opens to us the fathomless depths of ancient seas, and vast marshes, with the remains of myriads of beings which lived and died in their waters.

6. The ocean then swarmed with sponges and other zoophytes, sea-weeds, and corals, and Crustaceans; even oysters were abundant, but different from existing species; remains of a shark-like fish are found here; smaller fish were numerous; and in almost every fragment of some of the flint formations their minute scales have been detected by the aid of the microscope. On the land were several species of spiders, and insects in considerable numbers. The tracks of gigantic birds have been detected—"footprints in the sands of time"—in the rocks of this period; but of the existence of any mammalia, the sole indications are the jaws of some small animals related to the opossum.



GEOLOGICAL REMAINS OF ANIMALS OF THE UPPER SECONDARY PERIOD.

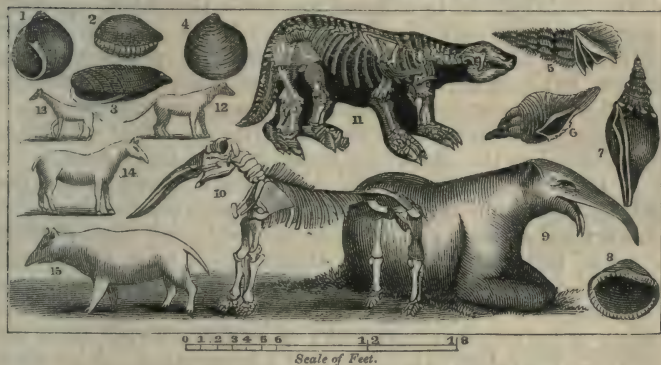
1, a Crinoidæ. These are sparingly found in this period. 2, 6, and 9 are remains of Echinites, or Sea-urchins. 3, 8, and 12 are Cretaceous shells. The fish here represented are from one to three feet in length. 5 is the *Pterodactyl*, or flying reptile, having the head and neck of a bird, the jaws and teeth of a crocodile, the wings of a bat, and the body and tail of a mammal. It is believed that the spread of its wings was not less than twenty-five feet. 13 is the restored figure of the *Iguanodon*, as drawn by Martin, and found in Mantell's *Geology*. In making a complete drawing of such an animal from its fossil remains, much of its external appearance must be left to the imagination. It is certain, however, that the *iguanodon* was a monster reptile, thirty or forty feet in length. From the form of its teeth, and the vegetable matter found in connection with its skeleton, it is known to have been herbivorous.

7. The remains of turtles, the earliest clear indications of the reptile tribe, occur in the Saliferous period; and above them, and later in point of time, but still in this Secondary era, are the remains of the crocodile. But what especially mark this as the *Age of Reptiles* are the numerous species of monster Saurians, bearing such uncouth names as the *ichthyosau'rus*, *plesiosau'rus*, *megalosau'rus*, and the *iguan'odon*, with the *pterodac'tyls*, or flying reptiles. In the island or peninsula of Portland, England, a petrified forest has been discovered in the upper formations of the Secondary period, and therefore contemporary with the monster reptiles whose

names we have given. We have represented the forms and dimensions of some of these monsters of a by-gone age as they have been pictured and described by geologists.

8. In closing our sketch of this Secondary period, we would remark, in the language of Hugh Miller, that at this period in the history of our country, "at the close of the Cretaceous system, there existed no *species* of plant or animal that exists at the present time. We know that it is appointed for all individuals once to die, whatever their tribe or family, because hitherto all individuals have died; and geology, by extending our experience, shows us that the same fate awaits on species as on the individuals that compose them." Of the several periods of existence which measure animated nature, the briefest is allotted to individuals: species live longer—genera longer still; while above them are orders and classes, the latter the most comprehensive of all.

LESSON VII.—THE TERTIARY PERIOD.



GEOLOGICAL REMAINS OF ANIMALS OF THE TERTIARY PERIOD.

[The scale of feet is applicable to all but the shells.]

1, 2, 3, 4, 5, 6, 7, 8, fossil Shells of the Tertiary period—very numerous. 9, the *Dinotherium*, an animal not less than fifteen feet in height, with immense tusks curving downward, and the proboscis of an elephant. 10, skeleton of a *Mastodon*, weighing 2000 pounds, found at Newburgh, N. Y., in 1845. 11, skeleton of a *Megatherium*; thigh-bone eleven inches in diameter, and claw-armed toes more than two feet in length. 12, 13, 14, and 15 are a group of extinct *Pachydermata*, which bear an affinity to the Tapir, Rhinoceros, and Hippopotamus. The largest, the *Pulchrotherium magnum*, was of the size of a horse, but more thick and clumsy.

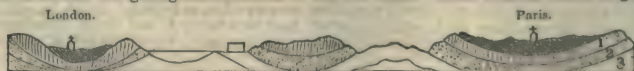
1. STILL ascending, in the order of time, in the geological history of our globe, we next come to the Tertiary period, likewise of vast and indefinite extent, but constituting a series

of formations which link together the present and the past. We have evidences of numerous changes in the earth's crust in the beginnings of this epoch, of volcanic action of great extent and frequency, and of alternations of ocean beds with those of vast fresh-water lakes. The alternating strata of this period have been divided into three principal groups, characterized by the proportion of shells, allied to existing species, which they contain. Thus the lowest group, the *eocene*, signifying *the dawn of the recent*, contains not more than three or four per cent. of fossil shells allied to those of recent species; the next, the *miocene*, about twenty per cent.; and the upper, the *pliocene*, about eighty per cent.*

2. But besides the marine and fresh-water shells which abound in this period, imbedded in vast layers of limestone rocks, the fossils of crabs, lobsters, and other Crustaceans are numerous; there have also been found the teeth of unknown sharks, and the remains of many genera of fishes, vast quantities of the remains of leaves, fruits, stems of plants, and trunks of trees *perforated by the borer*, together with the fossils of birds related to existing species. But what especially characterize the older Tertiary deposits are the numerous fossil remains of a class of pachydermata, of species now unknown, but bearing an affinity to the tapir, the rhinoceros, and the hippopotamus. Such are the numerous species of the *palæotherium* and the *anoplotherium*, some of which are represented in the engraving at the head of this lesson.

3. In the middle division of this period the seas became the habitation of numbers of marine mammalia, consisting of dolphins, whales, seals, and the manatee, although none of them were of the same species as those which exist at present. Here, also, are found the remains of the gigantic dinotherium—an animal not less than fifteen feet in height, with the proboscis of an elephant, and tusks curved downward as in the walrus. He seems to have formed a connecting link between

* It may be regarded as a singular coincidence that the capitals of Great Britain and France are located on strata of the same geological epoch in the Tertiary period. Both Paris and London are situated on a vast alternation of marine and fresh-water beds, lying in basins of the chalk formation, the uppermost of the Secondary period. The annexed cut illustrates the geological formation of the two cities. These ancient basins or gulfs



were evidently open to the sea on one side, while on the other they were supplied by rivers charged with the spoils of the country through which they flowed, and carrying down the remains of animals and plants, with land and river shells. Changes in the relative level of the land and sea took place, and, lastly, the country was elevated to its present altitude above the sea.—MANTELL.

the pachydermata, his predecessors, and those later mammalia, the Cetacea, or whales. There is little doubt that he was an inhabitant of the lakes and marshes, and that he could anchor himself to the firm land by his huge tusks. His singular appearance has inspired some one to write the following:

SONG OF THE DINOTHERIUM.

4

"My thirst I slake in the cooling lake,
Where I swim among the fishes,
And should hunger gnaw my vacant maw,
A dinner meets my wishes :
For bulbous roots or tender shoots
I dig or crop at pleasure,
And having dined, if to sleep inclined,
I lay me down at leisure.
As a ship will ride in the rushing tide
If her anchors meet the sand,
So when I sleep in the river deep,
My tusks are in the land."

5. In the lower division of the Tertiary the *bee* first makes its appearance, the fossil remains of one having been found sealed up in a piece of amber—"an embalmed corpse in a crystal coffin," as Hugh Miller beautifully describes it. Co-existent with the bee are the first of the Ophidians or serpents, as shown in a monster species allied to the modern python. Here also we first detect plants and trees belonging to well-known existing genera and orders, but not of existing species.

6. In the uppermost strata of this period are found remains of the mastodon, and also of numerous species of mammalia almost or nearly identical with many of the existing species. Thus, in vast caves of the later Tertiary period, accidentally opened in many places in Europe and Asia, have been found the skeletons of immense numbers of hyænas, mixed with the bones of the cave-tiger, the cave-bear, the mammoth, and the rhinoceros. The first traces also of ruminant animals appear at this time—of wild oxen, deer, camels, horses, and other creatures of the same class, and, even in high northern latitudes, the remains of species of elephants now unknown.

Yes! where the huntsman winds his matin horn,
And the couch'd hare beneath the covert trembles ;
Where shepherds tend their flocks, and grows the corn ;
Where Fashion on our gay parade assembles,
Wild horses, deer, and elephants have strayed,
Treading beneath their feet old Ocean's races.—HORACE SMITH.

LESSON VIII.—THE MODERN GEOLOGICAL PERIOD.

1. THE modern geological period embraces the two eras known as the Drift and the Alluvium. The *Drift* strata rest upon the Tertiary, and are spread over almost every part of the northern regions of the globe in the form of coarse sand and gravel, beds of clay, and rocks, called boulders, torn from the masses to which they belonged by the force of floods and glaciers; while the *Alluvium* consists of the surface soil, and layers of loam, sand, and fine gravel, evidently deposited by rivers, or in still water. In the Drift period, which was one of floods of vast extent, the climate of northern countries was evidently colder than during the Tertiary, and probably colder than at present. Hugh Miller describes our earth in this period as “a foundering land under a severe sky, beaten by tempests and lashed by tides, with glaciers half choking up its cheerless valleys, and with countless icebergs brushing its coasts and grating over its shallows.”

2. Drift, embracing a period of repeated depressions and elevations of the land, is almost destitute of organic remains of animals and plants that lived during the time of its production; but it abounds in immense quantities of the bones of those large mammalia which must have existed at the close of the Tertiary period. These remains belong principally to animals related to the elephant, as the mammoth and mastodon, and the various species of hippopotamus, rhinoceros, horse, ox, deer, and the animals whose remains were found in the caves already mentioned, and also throughout the frozen regions of northern Asia. The mastodon and a few other monster mammalia, now extinct, appear to have lived as late as the time of the earliest of the alluvial deposits. It is in the Alluvial period only that the remains of MAN and his works have thus far been found. “Geology, scarce less certainly than Revelation itself, testifies that the last-born of creation was man, and that his appearance on earth is one of the most recent events of which it submits the memorials to its votaries.”

“From harmony—from heavenly harmony—
This universal frame began;
From harmony to harmony,
Through all the compass of the notes it ran,
The *diapa'son* closing full in man.”

3. We have thus hastily glanced at the succession of ages which make up the geological history of our planet. We have seen land and water succeeding each other on our globe in

continual mutations; and we are thence prepared to admit the possibility that

"New worlds are still emerging from the deep,
The old descending in their turn to rise."

But what strikes us with the greatest force is the evidence of the successive creations which have peopled our planet; we have seen race after race of beings starting into existence, and then disappearing; for we know, by testimony which can not be controverted, that

"The earth has gathered to her breast again,
And yet again, the millions that were born
Of her unnumbered, unremembered tribes,"

and each tribe and race has been adapted to the circumstances in which it was placed, thereby affording the most evident proofs of the wisdom and overruling providence of the Creator. Reflecting on these phenomena, the mind recalls the impressive exclamation of the poet:

"My heart is awed within me when I think
Of the great miracle which still goes on
In silence round me—the perpetual work
Of Thy creation, *finished*, yet renewed
Forever."

LESSON IX.—RETROSPECTIVE VIEW OF GEOLOGY.

LET us now reverse the order of viewing the geological history of our globe, starting from the present, and proceed backward against the order of time. As the traveler who ascends to the regions of eternal snow gradually loses sight of the abodes of man, and of the groves and forests, till he arrives at sterile plains, where a few stunted shrubs alone meet his eye, and as he advances even these are lost, and mosses and lichens remain the only vestiges of organic life, and these too at length pass away, and he enters the confines of the inorganic kingdom of nature—in like manner the geologist who penetrates the secret recesses of the globe perceives at every step of his progress the existing forms of animals and vegetables gradually disappear, while the shades of other creations teem around him. These, in their turn, vanish from his sight; other new and strange modifications of organic structure supply their place; these also fade away; traces of animal and vegetable life become less and less manifest, till they altogether disappear; and he descends to the primary rocks, where all evidence of organization is lost, and the granite, like a pall thrown over the relics of a former world, conceals forever the earliest scenes of the earth's physical drama.

MANTELL.

LES. X.—A VISIT TO THE COUNTRY OF THE IGUANODON.

1. A VIVID idea of the "Age of Reptiles," and also of the subsequent changes in the earth's geological history, is given by the geologist, Dr. Mantell, in the following fanciful sketch, which the reader may suppose to have been written by a higher intelligence, who first visited our sphere "some millions of years ago," in that portion of the Secondary period denominated the "Age of Reptiles," when the now fossil forests of Portland were flourishing. The Sussex coast of England illustrates all the geological changes here described.

2. "Countless ages ere man was created I visited these regions of the earth, and beheld a beautiful country of vast extent, diversified by hill and dale, with its rivulets, streams, and mighty rivers flowing through fertile plains. Groves of palms and ferns, and forests of coniferous trees, clothed its surface; and I saw monsters of the reptile tribe, so huge that nothing among the existing races can compare with them, basking on the banks of its rivers and roaming through its forests; while in its fens and marshes were sporting thousands of crocodiles and turtles. Winged reptiles of strange forms shared with birds the dominion of the air, and the waters teemed with fishes, shells, and Crustacea.

3. "And after the lapse of many ages I again visited the earth; and the country, with its innumerable dragon-forms, and its tropical forests, all had disappeared, and an ocean had usurped their place. And its waters teemed with the nautilus and other molluscs, of races now extinct, and innumerable fishes and marine reptiles.*

4. "And thousands of years rolled by, and I returned, and lo! the ocean was gone, and dry land had again appeared, and it was covered with groves and forests; but these were wholly different in character from those of the vanished country of the iguanodon. And I beheld, quietly browsing, herds of deer of enormous size, and groups of elephants, mastodons, and other herbivorous animals of colossal magnitude. And I saw in its rivers and marshes the hippopotamus, tapir, and rhinoceros; and I heard the roar of the lion and the tiger, and the yell of the hyena and the bear.†

* This represents the *chalk* formation, embracing the uppermost strata of the Cretaceous system—the highest in the Secondary period. The chalk strata were evidently deposited in an ocean that must have covered, for many ages, the greater part of what is now central and southern Europe.

† This represents the uppermost formations of the Tertiary period—the *pliocene*.

5. "And another epoch passed away, and I came again to the scene of my former contemplations, and all the mighty forms which I had left had disappeared; the face of the country no longer presented the same aspect; it was broken into islands, and the bottom of the sea had become dry land, and what before was dry land had sunk beneath the waves. Herds of deer were still to be seen on the plains, with swine, and horses, and oxen; and wolves in the woods and forests. And I beheld human beings clad in the skins of animals, and armed with clubs and spears; and they had formed themselves habitations in caves, constructed huts for shelter, inclosed pastures for cattle, and were endeavoring to cultivate the soil.*

6. "And a thousand years elapsed, and I revisited the country, and a village had been built upon the sea-shore, and its inhabitants supported themselves by fishing; and they had erected a temple on the neighboring hill, and dedicated it to their patron saint. And the adjacent country was studded with towns and villages; and the downs were covered with flocks, and the valleys with herds, and the corn-fields and pastures were in a high state of cultivation, denoting an industrious and peaceful community.†

7. "And, lastly, after an interval of many centuries, I arrived once more, and the village was swept away, and its site covered by the waves; but in the valley and on the hills above the cliffs a beautiful city appeared, with its palaces, its temples, and its thousand edifices, and its streets teeming with a busy population in the highest state of civilization; the resort of the nobles of the land, the residence of the monarch of a mighty empire. And I perceived many of its intelligent inhabitants gathering together the vestiges of the beings which had lived and died, and whose very forms were now obliterated from the face of the earth, and endeavoring, by these natural memorials, to trace the succession of those events of which I had been the witness, and which had preceded the history of their race."‡

* This represents the earlier periods of the *Alluvium*—what Hugh Miller calls the "stone age;" in which are found, in the British Isles, remains of man, with weapons and utensils of stone.

† This represents a period subsequent to the Roman invasion, when the inhabitants of Britain had utensils and weapons formed of iron. Before the Conquest the fishing town of Brighton was on a terrace of beach and sand (which the ocean had abandoned) on the Sussex coast; and the church of St. Nicholas stood inland on a neighboring cliff, which showed the mark of the waves at its base.

‡ This represents the present era. The old fishing-town of Brighton is now covered by the sea, which has resumed its ancient position at the base of the cliffs; and a great city (London) has grown up a little farther inland—the metropolis of a mighty empire.

LESSON XI.—THE VISION OF MOSES.

1. Most geologists suppose that the "six days" work of the creation, as described in the first chapter of Genesis, were a connected series of so many prophetic visions—a kind of diorama which passed before the prophet Moses—unfolding to him, in this inspired manner, the record of the works of the Almighty. The celebrated geologist Hugh Miller—a Christian and a scholar—has drawn a portraiture of this vision in language so beautiful that we can not forbear to insert it here. He supposes the "first day" to represent that "Primary period" ushered in by the first morn which dawned after a long night of chaos, and during which no life appears upon our planet.

2. "Let us suppose that the creative vision took place far from man, in an untrodden recess of the Midian desert, ere yet the vision of the burning bush had been vouchsafed, and that, as in the vision of St. John in Patmos, voices were mingled with scenes, and the ear as certainly addressed as the eye. A 'great darkness' first falls upon the prophet, like that which in an earlier age fell upon Abraham, but without the 'horror;' and, as the Divine Spirit moves on the face of the wildly-troubled waters, like a visible aurora enveloped by the pitchy cloud, the great doctrine is orally enunciated, that 'in the beginning God created the heavens and the earth.'

3. "Unreckoned ages, condensed in the vision into a few brief moments, pass away; the creative voice is again heard, 'Let there be light,' and straightway a gray diffused light springs up in the east, and, casting its sickly gleam over a cloud-limited expanse of steaming vaporous sea, journeys through the heavens toward the west. One heavy, sunless day is made the representative of myriads: the faint light waxes fainter—it sinks beneath the dim, undefined horizon; the first scene of the drama closes upon the seer; and he sits a while on his hill-top in darkness, solitary, but not sad, in what seems to be a calm and starless night."

4. The "second day" is supposed to open about the close of the Transition period, when only a few plants and marine animals had appeared, and the view of the prophet rested upon a dark waste of troubled waters.

"The light again brightens: it is day; and over an expanse of ocean without visible bound, the horizon has become wider and sharper of outline than before. There is life in that great sea—invertebrate, mayhap also ichthyic life; but from the comparative distance of the point of view occupied by the prophet, only the slow roll of its waves can be discerned, as they rise and fall in long undulations before a gentle gale; and what most strongly impresses the eye is the change which has taken place in the atmospheric scenery.

5. "That lower stratum of the heavens occupied in the previous vision by seething steam, or gray, smoke-like fog, is clear and transparent; and only in an upper region, where the previously invisible vapor of the tepid

sea has thickened in the cold, do the clouds appear. But there, in the higher strata of the atmosphere, they lie, thick and manifold, an upper sea of great waves, separated from those beneath by the transparent firmament, and, like them too, impelled in rolling masses by the wind. A mighty advance has taken place in creation; but its most conspicuous optical sign is the existence of a transparent atmosphere, of a firmament stretched out over the earth, that separates the waters above from the waters below. But darkness descends for the third time upon the seer, for the evening and the morning have completed the second day."

6. The "third day" is supposed to have dawned upon that early part of the "Secondary period" when the Carboniferous era had covered the earth with a wonderfully gigantic and abundant vegetation.

7. "Yet again the light rises under a canopy of cloud; but the scene has changed, and there is no longer an unbroken expanse of sea. The white surf breaks, at the distant horizon, on an insulated reef, formed mayhap by the Silurian or old red coral zoophytes ages before, during the bygone yesterday, and beats in long lines of foam, nearer at hand, against a low, winding shore, the seaward barrier of a widely-spread country. For at the Divine command the land has arisen from the deep; not inconspicuously and in scattered islets, as at an earlier time, but in extensive, though flat and marshy continents, little raised over the sea-level; and a yet farther fiat has covered them with the great Carboniferous flora.

8. "The scene is one of mighty forests of cone-bearing trees—of palms, and tree ferns, and gigantic club mosses on the opener slopes, and of great reeds clustering by the sides of quiet lakes and dark rolling rivers. There is deep gloom in the recesses of the thicker woods, and low thick mists creep along the dank marsh or sluggish stream. But there is a general lightening of the sky overhead; and, as the day declines, a redder flush than had hitherto lighted up the prospect falls athwart fern-covered bank and long-withdrawing glade."

9. The "fourth day" is supposed to have dawned upon the middle of the Secondary period—perhaps the Saliferous era—and the vision, like that of the second day, pertains not to the earth, but to the heavens; as the vast mantle of cloud and dense vapor that had hitherto enveloped the earth had then disappeared, and the sun, moon, and stars may be supposed to have first become visible to the prophet.

10. "And while the fourth evening has fallen on the prophet, he becomes sensible, as it wears on, and the fourth dawn approaches, that yet another change has taken place. The Creator has spoken, and the stars look out from openings of deep unclouded blue; and as day rises, and the planet of morning pales in the east, the broken cloudlets are transmuted from bronze into gold, and anon the gold becomes fire, and at length the glorious sun rises out of the sea, and enters on his course rejoicing. It is a brilliant day; the waves, of a deeper and softer hue than before, dance and sparkle in the light; the earth, with little else to attract the gaze, has assumed a garb of brighter green; and as the sun declines amid even richer glories than those which had encircled his rising, the moon appears full-orbed in the east—to the human eye the second great luminary of the heavens—and climbs slowly to the zenith as night advances, shedding its mild radiance on land and sea."

11. The vision of the "fifth day" may be supposed to open upon the latter part of the Secondary period, the "Age of Reptiles."

"Again the day breaks; the prospect consists, as before, of land and ocean. There are great pine woods, reed-covered swamps, wide plains, winding rivers, and broad lakes; and a bright sun shines over all. But the landscape derives its interest and novelty from a feature unmarked before. Gigantic birds stalk along the sands, or wade far into the water in quest of their ichthyic food; while birds of lesser size float upon the lakes, or scream discordant in hovering flocks, thick as insects in the calm of a summer evening, over the narrower seas, or brighten with the sunlit gleam of their wings the thick woods.

12. "And ocean has its monsters: great '*tanninim*' tempest the deep as they heave their huge bulk over the surface to inhale the life-sustaining air; and out of their nostrils goeth smoke, as out of a 'seething pot or caldron.' Monstrous creatures armed in massive scales haunt the rivers, or scour the flat, rank meadows; earth, air, and water are charged with animal life; and the sun sets on a busy scene, in which unerring instinct pursues unremittingly its few simple ends, the support and preservation of the individual, the propagation of the species, and the protection and maintenance of the young."

13. The vision of the "sixth day" may be supposed to open near the close of the Tertiary period, when gigantic mammals possessed the earth. To the evening of this sixth day, in the eras of the Drift and Alluvium, man belongs—at once the last created of terrestrial creatures, and infinitely beyond comparison the most elevated in the scale; and with man's appearance on the scene the days of creation end, and the Divine Sabbath begins.

14. "Again the night descends, for the fifth day has closed; and morning breaks on the sixth and last day of creation. Cattle and beasts of the fields graze on the plains; the thick-skinned rhinoceros wallows in the marshes; the squat hippopotamus rustles among the reeds, or plunges suddenly into the river; great herds of elephants seek their food amid the young herbage of the woods; while animals of fiercer nature—the lion, the leopard, and the bear—harbor in deep caves till the evening, or lie in wait for their prey amid tangled thickets or beneath some broken bank.

15. "At length, as the day wanes and the shadows lengthen, man, the responsible lord of creation, formed in God's own image, is introduced upon the scene, and the work of creation ceases forever upon the earth. The night falls once more upon the prospect, and there dawns yet another morrow—the morrow of God's rest—that Divine Sabbath in which there is no more creative labor, and which, "blessed and sanctified" beyond all the days that had gone before, has as its special object the moral elevation and redemption of man. And over *it* no evening is represented in the record as falling, for its special work is not yet complete.

16. "Such seems to have been the sublime panorama of creation exhibited in vision of old to

"The shepherd who first taught the chosen seed
In the beginning how the heavens and earth
Rose out of chaos,"

and, rightly understood, I know not a single scientific truth that militates against even the minutest or least prominent of its details."

LESSON XII.—GEOLOGICAL AGENCIES NOW IN OPERATION.

1. HAVING briefly sketched the geological changes through which the crust or shell of our planet has passed during the myriads of ages of its past history, it will now be interesting to consider the geological agencies still in operation, which are continually producing new changes.

2. The atmosphere itself, with its alternations of heat and cold, dryness and moisture, wind and rain, storms and tempests, is gradually but constantly acting on the hardest rocks, causing them to crumble and become soluble, and thus preparing them, as soil, to enter into the minute rootlets of plants and nourish their growth. Thus hills and mountains are wearing down by atmospheric agencies, and the rain, the rivers, and the floods, are bearing the particles which compose them to the ocean. One of the first lessons which geology teaches is, that lofty mountains,

" Whose tops appear to shroud
Their granite peaks deep in the vapory cloud,
Worn by the tempests, wasted by the rains,
Sink slowly down to fill wide ocean's plains.
The ocean's deeps new lands again display,
And life and beauty drink the light of day."

3. In this manner the land at the mouths of large rivers sometimes rapidly encroaches upon the sea. The delta of the Nile, formed of the mud, and sand, and gravel brought down from the high lands and mountains of the interior, is nearly as large as the state of Vermont: most of the lower part of Louisiana is the gift of the Mississippi; and it is stated that the annual deposit made by the waters of that river is sufficient to cover a township of six miles square to the depth of thirty feet. The Amazon brings down a still greater amount of materials, which, instead of forming a delta, are borne away by the ocean currents, serving to fill up "ocean's plains," or perhaps to form new lands on distant shores.

4. The civil engineer who has seen his firm piers and walls demolished by the tremendous waves of an ocean storm, can well appreciate their powerful action as agents in modifying the rocky and earthy structure of the globe. In the Isle of Man a rock weighing two hundred pounds was lifted from its place and carried inland on a high wave of the sea; and in the Hebrides a block of forty-two tons was moved several feet by the force of the waves. The "stern and rock-bound coast"

of the ocean every where feels the abrading power of the waves, as is shown by such projections as the "Pulpit Rock" at Nahant, and others equally picturesque along our whole Atlantic coast.

5. The sands and pebbles that are now so abundant in sand and gravel beds, were once broken from rocks, and worn into their present rounded forms by constant rubbing against each other in water. A history of one of these little pebbles—torn from some mountain peak of ancient continent by glacier, or avalanche, or frost, or tempest—making its way downward by mountain currents—borne onward by some ancient river to the ocean—buffeted there by the waves for ages, and finally deposited in some gravel-bed, would form an interesting picture of geological changes, which has myriads of counterparts in the slow formation of sand and pebbles in the rivers and oceans of the present day.

6. "A wondrous traveler was of yore
The rounded pebble-stone
As he rolled along from shore to shore,
In rivers now unknown.
7. Where ancient forests grew and waved,
Where ancient streams did flow,
That little pebble journeyed on,
In the river's bed below.
8. Early and late he must have gone,
No rest nor sleep had he,
Until he slept in his gravel-bed
Beneath the sounding sea."

9. The destroying effects of waves have been disastrously exhibited in Holland, a country lower than the level to which the bordering sea rises during high tides and storms. The author of *Hudibras* has humorously described Holland as a country "that draws fifty feet of water;" but the inhabitants contrive to keep the sea from their lands by *dikes* or embankments. Sometimes the dikes are inadequate to withstand the force of the waters, and destructive inundations lay waste large districts of country. On the 17th of April, 1446, the sea broke in at Dort, and destroyed seventy-two villages and one hundred thousand people. At this time a large part of the Zuyder Zee was formed. In 1530 another great inundation occurred, in which four hundred thousand people are said to have perished.

10. The effects of glaciers and mountain slides in changing the aspects of mountain scenery have already been alluded to in the division on Physical Geography. Icebergs are glaciers formed in the higher latitudes along the coasts and in bays; and when torn from their moorings they often bear

away with them immense rocks and masses of earth, which they deposit in distant parts of the ocean.

11. Volcanoes and earthquakes are the most terrible in their effects of all geological agencies; but the actual geological changes which they produce are much less important than those occasioned by what are apparently the most insignificant of animals—the little coral polypes, shell-fish, and invisible animalcules. The latter minute organisms, so small that millions of them might sport freely in a drop of water, are now, as in ages past, important geological agencies, floating in the air we breathe, adding to the soil we cultivate, and forming vast layers of rocky strata at the bottom of the ocean.

12. The rotten-stone or polishing powder, called *tripoli*, is composed of the flinty shells of animalcules; and there are extensive marl-beds in our country composed of similar materials. Eminent geologists have expressed the belief that all the lime of our marble-quarries and chalk-beds has been formed of the shells of organized bodies—probably deposited at the bottom of the ocean, as lime-beds are now forming there.

“The earth that's Nature's mother is her tomb,”

is the scientific assertion of Shakspeare; and even the contemplative Young inquires,

“Where is the dust that has not been alive?”

13. The coral-building animals have been partially described in the division on Physical Geography; but we are now prepared to regard them as the most important of all geological agents. They are actually filling up portions of the Pacific Ocean: coral islands are now numbered there by thousands, and coral reefs are hundreds of miles in extent; and if the slow operations of these little animals shall continue as long as some of the geological periods which we have noticed, the result will be a new continent there.

LESSON XIII.—CORAL ISLANDS.

[See Illustration, p. 371.]

1. I saw the living pile ascend,
The mausoleum of its architects,
Still dying upward as their labors closed;
Slime the material, but the slime was turned
To adamant by their petrific touch.
Frail were their frames, ephemeral their lives,

- Their masonry imperishable. All
 Life's needful functions, food, exertion, rest,
 By wise economy of Providence,
 Were overruled, to carry on the process
 Which out of water brought forth solid rock.
2. Atom by atom, thus the mountain grew
 A coral island, stretching east and west;
 Steep were the flanks, with precipices sharp,
 Descending to their base in ocean gloom.
 Chasms few, and narrow, and irregular,
 Formed harbors, safe at once and perilous—
 Safe for defense, but perilous to enter.
 A sea-lake shone amid the fossil isle,
 Reflecting in a ring its cliffs and caverns,
 With heaven itself seen in a lake below.
3. Compared with this amazing edifice,
 Raised by the weakest creatures in existence,
 What are the works of intellectual man,
 His temples, palaces, and sepulchres?
 Dust in the balance, atoms in the gale,
 Compared with these achievements in the deep,
 Were all the monuments of olden time.
4. Egypt's gray piles of hieroglyphic grandeur,
 That have survived the language which they speak,
 Preserving its dead emblems to the eye,
 Yet hiding from the eye what these reveal;
 Her pyramids would be mere pinnacles,
 Her giant statues, wrought from rocks of granite,
 But puny ornaments for such a pile
 As this stupendous mount of catacombs,
 Filled with dry mummies of the builder-worms.

MONTGOMERY.

LESSON XIV.—GEOLOGICAL MONUMENTS.

IF we look with wonder upon the great remains of human works, such as the columns of Palmyra, broken in the midst of the desert, the temples of Pæstum, beautiful in the decay of twenty centuries, or the mutilated fragments of Greek sculpture in the Acropolis of Athens, or in our own museums, as proofs of the genius of artists, and power and riches of nations now passed away, with how much deeper feeling of admiration must we consider those grand monuments of nature which mark the revolutions of the globe—continents broken into islands; one land produced, another destroyed; the bottom of the ocean become a fertile soil; whole races of animals extinct, and the bones and exuviae¹ of one class covered with the remains of another; and upon the graves

of past generations—the marble or rocky tombs, as it were, of a former animated world—new generations rising, and order and harmony established, and a system of life and beauty produced out of chaos and death, proving the infinite power, wisdom, and goodness of the GREAT CAUSE of all things.—
SIR H. DAVY.

¹ Ek-ū'-vi-ē (egz-yū'-ve-e), whatever is put off, or shed and left, by animals or by plants; the cast skin, shells, etc., of animals.

LESSON XV.—MINERALOGY: THE ALPHABET OF GEOLOGY.

SIMPLE MINERALS.

1. IN the language of geology, all natural bodies that are neither animal nor vegetable are called *minerals*. In this view, not only are all kinds of clay, stones, and the metals to be considered minerals, but water also must be included in the list. If the earth were sufficiently heated, the rocks themselves would melt and flow like water, as we see in the case of melted lava; and, if the earth were sufficiently cold, we should rarely see water, except in the rock-form of crystal-like masses of ice.

2. *Mineralogy*, therefore, whose subject is minerals, treats of all the *inorganic* substances that are found in the earth or on its surface; it arranges and classifies them, it designates the ingredients of which they are composed, and it describes their properties. Hence minerals are the very alphabet of geology; and mineralogy is only a branch of that science whose grand historical outlines we have just been considering.

3. Of what, then, are the materials of the earth composed? It would seem, at first view, that they must be almost infinite in number and variety; that a thousand kinds of stone and earth might easily be gathered, and that no limits could be assigned to the extent of *such* a geological collection. But a little examination shows that this vast multitude of seemingly different kinds of rock and earth, and clayey and marly soils, is composed of only a few primary ingredients, although they are combined in a great variety of forms and proportions.

4. Mineralogy, no less than geology, is full of wonders; one of the greatest of which is that the life-sustaining oxygen which we breathe so freely in pure air enters so largely into the composition of rocks and earths as to constitute *one half* of the solid materials of our globe! This is the first, sim-

ple, but all-important lesson in mineralogy. A second lesson teaches us that, out of nearly sixty pure mineral substances which are known, six of them, although seldom obtained in a separate state, are found so largely combined with this same oxygen as to form, in this compound state, nineteen twentieths of all the rocks and earths which are known. Thus ten twentieths of the inorganic parts of our globe are composed of oxygen; six mineral substances go to make up nine twentieths more; and the remaining one twentieth is composed of other minerals.

5. The six mineral substances, or mineral *bases*, to which we have alluded, have been named *silicon*, *calcium*, *aluminum*, *magnesium*, *potassium*, and *sodium*. Thus silicon unites with oxygen in certain proportions to form the well-known and abundant flinty or *quartz* rock. When quartz is broken down into fine grains, and consolidated or cemented with oxyd of iron, it forms sandstone rock; and, in the form of finely-powdered sand, it is an important ingredient in the soil we cultivate. Calcium and oxygen form *lime*; and when this is united with carbonic acid, the result is *limestone rock*, which is also an ingredient of our best soils. Similar combinations of the other mineral bases with oxygen form *alumina*, *magnesia*, and *soda*, which also enter to a considerable extent into the composition of the rocky and earthy portions of the globe.

6. The most abundant of the simple minerals, or *rocks*, as they are generally called, which are formed chiefly by the simple union of oxygen with the six mineral substances mentioned, but in some instances by additional combinations, are quartz, feldspar, limestone, hornblende, mica, tale, and serpentine; and these are distinguished and described by their color, and their several degrees of lustre, transparency, specific gravity, hardness, fracture, tenacity, taste when soluble, and odor when rubbed.

7. Of these minerals, *quartz*, which enters largely into the compound minerals or rocks, constitutes by itself nearly one half of the crust of the earth. Pure quartz, which is crystallized silica, scratches glass with facility, and is next to the diamond in hardness. Flint and rock-crystal are well known forms of this mineral, but it occurs in numerqus other varieties; and when colored by iron, manganese, chrome, and other foreign substances, it produces many valuable gems or precious stones, such as opal, jasper, amethyst, agates, and carnelians. The sand which is used in making mortar and glass

is mostly quartz; and in what is called *silex* this mineral forms the hard, flinty covering of the grasses.

8. *Feldspar*, or feldspar, which contains a large proportion of alumina, the basis of clay, composes about one tenth of the crust of the globe. It is of various colors, is not so hard as quartz, and is less glassy in appearance. It is used extensively in the manufacture of porcelain. Common clay is impure decomposed feldspar.

9. *Limestone*, forming about one seventh of the crust of the earth, presents numerous varieties—from the common chalk, cavern stalactites, and coarse limestone rock, to the beautiful crystalline spars and the finest marble.

10. *Hornblende*, a tough mineral, as implied in the name it bears, constitutes a large part of the rocks of volcanic origin and some of the older slate rocks. It forms about one fifteenth of the crust of the earth. One of its varieties is the remarkable asbestos, whose slender fibres may be woven into cloth which will be incombustible.

11. *Mica*, often improperly called isinglass, is a soft mineral, usually of a light green color, and is about as abundant as hornblende. Thin plates of it are often used for lanterns and stove windows.

12. *Talc* resembles mica, but is softer, and may be easily cut with a knife. Steatite, or soap-stone, one of its varieties, is extensively used for fireplaces and stove linings.

13. *Serpentine*, which is of various colors, is harder than limestone. Its finer varieties, which admit a high polish, are an elegant substitute for marble.

14. *Gypsum*, or “plaster of Paris,” *rock-salt*, and *coal*, complete the list of minerals which form any considerable portion of the earth’s crust.

LESSON XVI.—COMPOUND MINERALS.

1. **GRANITE**, which forms so large a proportion of the primary rocks, is a crystalline aggregate of quartz, feldspar, and mica. It is a very hard and durable rock, and is much used in building and for pavements. Granite seems to be the general foundation-stone or *underpinning* of the other rocks, and it is also found as high as the summit of Mount Blanc.

2. Granite is abundant in New England. The most celebrated quarries are at Quincy, Mass. The Quincy granite, however, is not properly a *granite*, but a *syenite*, in which

hornblende takes the place of mica. Bunker Hill Monument, the Astor House in New York City, and the dry-docks at the Charlestown and Gosport Navy-yards, are constructed of this rock. Granite is also found abundantly, and of the finest quality, in Virginia, Georgia, and other states.

3. There is an unstratified igneous rock, called *porphyry*, which is of a reddish color, and contains crystals of feldspar. Another compound rock is called *pudding-stone*. It is a conglomerate of rounded pebbles cemented together by fine-grained sandy paste. When cut and polished, it resembles in appearance a slice of plum-pudding, and is much used for ornamental purposes.

4. *Amygdaloid* is a rock containing almond-shaped cavities. These cavities have been formed by the escape of gases as the rock cooled down from a melted state. The rock itself is evidently a kind of solidified lava, and the cavities have been subsequently filled with some mineral matter, as quartz, lime, or agate.

5. *Breccia* is composed of angular fragments which once constituted other rocks. It differs from pudding-stone in not having the fragments worn into the form of pebbles. The Potomac marble, of which fine specimens are seen in the old national Capitol at Washington, is a kind of *breccia*.¹ Brecciated² marble from Vermont and Tennessee have been extensively used in the interior of the new United States Capitol.

The composition of these rocks has been presented in the following *recipes* for GEOLOGICAL COOKERY:

6. *To make Granite.*

Of feldspar and quartz a large quantity take,
Then pepper with mica, and mix up and bake.
This granite for common occasions is good;
But on saint's days and Sundays, be it understood,
If with bishops and lords in the state-room you dine,
Then sprinkle with topaz, or else tourmaline.

7. *To make Porphyry.*

Let silex and argil be well kneaded down,
Then color at pleasure, red, gray, green, or brown;
When the paste is all ready, stick in here and there
Small crystals of feldspar, both oblong and square.

8. *To make Pudding-stone.*

To vary your dishes, and shun any waste,
Should you have any left of the very same paste,
You may make a plum-pudding; but, then, do not stint
The quantum of pebbles—chert, jasper, or flint.

9. *To make Amygdaloid.*

Take a mountain of trap, somewhat softish and green,
 In which bladder-shaped holes may be every where seen;
 Choose a part where these holes are decidedly void all,
 Pour silex in these, to form agates spheroidal,
 And the mass in a trice will be amygdaloidal.

10. *To make a good Breccia.*

Break your rocks in sharp fragments, preserving the angles;
 Of mica or quartz you may add a few spangles;
 Then let your white batter be well filtered through,
 Till the parts stick as firm as if fastened by glue.

11. *To make a coarser Breccia.*

For a breccia more coarse you may vary your matter;
 Pound clay, quartz, and iron-stone, moistened with water:
 Pour these on your fragments, and then wait a while,
 Till the oxyd of iron is red as a tile.

¹ BRECC'-CIA (pronounced *Brek'-sha*).² BRECC'-CIA'-TED (pronounced *Brek'-she-ät-ed*).

LESSON XVII.—BRIEF EXTRACTS.

1. "GEOLOGY, in the magnitude and sublimity of the objects of which it treats, undoubtedly ranks next to astronomy in the scale of the sciences."—SIR J. F. W. HERSCHEL.

2. "Every rock in the desert, every boulder on the plain, every pebble by the brook side, every grain of sand on the sea-shore, is replete with lessons of wisdom to the mind that is fitted to receive and comprehend their sublime import."

3. "The very ground on which we tread, and the mountains which surround us, may be regarded as vast tumuli, in which the organic remains of a former world are enshrined."
 —PARKINSON.

4. "To the natural philosopher the rocks and the mountains are the grand monuments of nature, on which is inscribed the history of the physical revolutions of the globe, which took place in periods incalculably remote, and long antecedent to the creation of the human race. They present to his mind a succession of events, each so vast as to be beyond his finite comprehension; ages of tranquillity, with lands and seas teeming with life and happiness, succeeded by periods in which the earthquake and the volcano spread universal ruin and destruction; and they teach him that all these awful changes bear the impress of the ALMIGHTY hand, and were subservient to the eternal purpose of rendering this planet the fit abode of MAN during his mortal pilgrimage."—MANTELL.

LESSON XVIII.—CONCLUDING REMARKS.

[From the conclusion of MANTELL'S *Wonders of Geology*.]

1. WITH these remarks, I conclude this attempt to combine a general view of geological phenomena with a familiar exposition of the inductions by which the leading principles of the science have been established. And if I have succeeded in explaining in a satisfactory manner how, by laborious and patient investigation, and the successful application of other branches of natural philosophy, the wonders of geology have been revealed—if I have removed but from one intelligent mind any prejudice against scientific inquiries which may have been excited by those who have neither the relish nor the capacity for philosophical pursuits—if I have been so fortunate as to kindle in the hearts of others that intense and enduring love and admiration of natural knowledge which I feel in my own, or have illuminated the mental vision with that intellectual light which, once kindled, can never be extinguished, and which reveals to the soul the beauty, and wisdom, and harmony of the works of the Eternal, I shall indeed rejoice, for then my exertions will not have been in vain. And although my humble name may be soon forgotten, and all record of my labors be effaced, yet the influence of that knowledge, however feeble it may be, which has emanated from my researches, will remain forever, and, by conducting to new and inexhaustible fields of inquiry, prove a never-failing source of the most pure and elevated gratification.

2. It is indeed the peculiar charm and privilege of natural philosophy that it

Can so inform
The mind that is within us—so impress
With quietness and beauty, and so feed
With lofty thoughts, that neither evil tongues,
Rash judgments, nor the sneers of selfish men,
Nor greetings where no kindness is, nor all
The dreary intercourse of common life,
Can e'er prevail against us, or disturb
Our cheerful faith, that all which we behold
Is full of blessings!—WORDSWORTH.

For to one imbued with a taste for natural science, Nature unfolds “her hoarded poetry and her hidden spells;” for him there is a voice in the winds and a language in the waves, and he is

Even as one
Who, by some secret gift of soul or eye,
In every spot beneath the smiling sun,
Sees where the *springs of living waters lie*!—HERMANS.

TENTH MISCELLANEOUS DIVISION.



LESSON I.—THE RAVEN.

EDGAR A. POE.

1. ONCE upon a midnight dreary, while I pondered weak and weary,
Over many a quaint and curious volume of forgotten lore—
While I nodded, nearly napping, suddenly there came a tapping,
As of some one gently rapping, rapping at my chamber door.
“’Tis some visitor,” I muttered, “tapping at my chamber door—
Only this and nothing more.”
2. Ah! distinctly I remember it was in the bleak December,
And each separate dying ember wrought its ghost upon the floor.
Eagerly I wished the morrow; vainly I had sought to borrow
From my books surcease of sorrow—sorrow for the lost Lenore—

For the rare and radiant maiden whom the angels name Lenore—

Nameless here for evermore.

3. And the silken sad uncertain rustling of each purple curtain
Thrilled me—filled me with fantastic terrors never felt before;
So that now, to still the beating of my heart, I stood repeating,
"Tis some visitor entreating entrance at my chamber door—
Some late visitor entreating entrance at my chamber door;
This it is and nothing more.
4. Presently my soul grew stronger; hesitating then no longer,
"Sir," said I, "or madam, truly your forgiveness I implore;
But the fact is I was napping, and so gently you came rapping,
And so faintly you came tapping, tapping at my chamber door,
That I scarce was sure I heard you"—here I opened wide the door—
Darkness there and nothing more.
5. Deep into that darkness peering, long I stood there wondering, fearing,
Doubting, dreaming dreams no mortal ever dared to dream before;
But the silence was unbroken, and the stillness gave no token,
And the only word there spoken was the whispered word "Lenore?"
This I whispered, and an echo murmured back the word "Lenore!"—
Merely this and nothing more.
6. Back into the chamber turning, all my soul within me burning,
Soon again I heard a tapping something louder than before.
"Surely," said I, "surely that is something at my window lattice;
Let me see, then, what thereat is and this mystery explore—
Let my heart be still a moment and this mystery explore—
'Tis the wind and nothing more.
7. Open here I flung the shutter, when, with many a flirt and flutter,
In there stepped a stately raven of the saintly days of yore.
Not the least obeisance made he; not a minute stopped or stayed he;
But, with mien of lord or lady, perched above my chamber door—
Perched upon a bust of Pallas just above my chamber door—
Perched, and sat, and nothing more.
8. Then this ebony bird beguiling my sad fancy into smiling,
By the grave and stern decorum of the countenance it wore,
"Though thy crest be shorn and shaven, thou," I said, "art sure no
craven,
Ghastly grim and ancient raven wandering from the nightly shore—
Tell me what thy lordly name is on the night's Plutonian shore!"
Quoth the raven, "Nevermore."
9. Much I marveled this ungainly fowl to hear discourse so plainly,
Though its answer little meaning—little relevancy bore;
For we can not help agreeing that no living human being
Ever yet was blessed with seeing bird above his chamber door—
Bird or beast upon the sculptured bust above his chamber door,
With such name as "Nevermore."
10. But the raven, sitting lonely on that placid bust, spoke only
That one word, as if his soul in that one word he did outpour.
Nothing farther then he uttered—not a feather then he fluttered—
Till I scarcely more than muttered, "Other friends have flown before—
On the morrow he will leave me, as my hopes have flown before."
Then the bird said "Nevermore."

11. Startled at the stillness broken by reply so aptly spoken,
 "Doubtless," said I, "what it utters is its only stock and store,
 Caught from some unhappy master whom unmerciful disaster
 Followed fast and followed faster till his songs one burden bore—
 Till the dirges of his hope that melancholy burden bore
 Of 'Never—nevermore.'"
12. But the raven still beguiling all my sad soul into smiling,
 Straight I wheeled a cushioned seat in front of bird, and bust, and door;
 Then, upon the velvet sinking, I betook myself to linking
 Fancy unto fancy, thinking what this ominous bird of yore—
 What this grim, ungainly, ghastly, gaunt, and ominous bird of yore
 Meant in croaking "Nevermore."
13. This I sat engaged in guessing, but no syllable expressing
 To the fowl whose fiery eyes now burned into my bosom's core;
 This and more I sat divining, with my head at ease reclining
 On the cushion's velvet lining that the lamplight gloated o'er,
 But whose velvet violet lining with the lamplight gloating o'er
 She shall press, ah! nevermore.
14. Then, methought, the air grew denser, perfumed from an unseen censer
 Swung by seraphim whose footfalls tinkled on the tufted floor.
 "Wretch," I cried, "thy God hath lent thee—by these angels he hath
 sent thee
 Respite—respite and nepenthe from thy memories of Lenore!
 Quaff, oh quaff this kind nepenthe and forget this lost Lenore!"
 Quoth the raven, "Nevermore."
15. "Prophet!" said I, "thing of evil!—prophet still, if bird or devil!—
 Whether Tempter sent, or whether tempest tossed thee here ashore,
 Desolate yet all undaunted, on this desert land enchanted—
 On this home by horror haunted—tell me truly, I implore—
 Is there—is there balm in Gilead?—tell me—tell me, I implore!"
 Quoth the raven, "Nevermore."
16. "Prophet!" said I, "thing of evil—prophet still, if bird or devil!
 By that heaven that bends above us—by that God we both adore—
 Tell this soul with sorrow laden if, within the distant Aidenn,
 It shall clasp a sainted maiden whom the angels name Lenore—
 Clasp a rare and radiant maiden whom the angels name Lenore."
 Quoth the raven, "Nevermore."
17. "Be that word our sign of parting, bird or fiend!" I shrieked, up-
 starting—
 "Get thee back into the tempest and the night's Plutonian shore!
 Leave no black plume as a token of that lie thy soul hath spoken!
 Leave my loneliness unbroken!—quit the bust above my door!
 Take thy beak from out my heart, and take thy form from off my door!"
 Quoth the raven, "Nevermore."
18. And the raven, never flitting, still is sitting, still is sitting
 On the pallid bust of Pallas just above my chamber door;
 And his eyes have all the seeming of a demon's that is dreaming,
 And the lamplight o'er him streaming throws his shadow on the floor;
 And my soul from out that shadow that lies floating on the floor
 Shall be lifted—nevermore!

LESSON II.—THE DIGNITY OF WORK.

1. THERE is a perennial nobleness, and even sacredness, in work. Were he never so benighted, forgetful of his high calling, there is always hope in a man that actually and earnestly works; in idleness alone is there perpetual despair. Work, never so mammonish, mean, is in communication with Nature; the real desire to get work done will itself lead one more and more to truth, to Nature's appointments and regulations which are truth.

2. All true work is sacred: in all true work, were it but true hand-labor, there is something of divineness. Labor, wide as the earth, has its summit in heaven. Sweat of the brow; and up from that to sweat of the brain, sweat of the heart; which includes all Kepler calculations, Newton meditations, all sciences, all spoken epics, all acted heroism, martyrdoms—up to that “agony of bloody sweat,” which all men have called divine! Oh brother, if this is not “worship,” then I say, the more pity for worship; for this is the noblest thing yet discovered under God's sky.

3. Who art thou that complainest of thy life of toil? Complain not. Look up, my wearied brother; see thy fellow-workmen there, in God's eternity; surviving there, they alone surviving: sacred band of the immortals, celestial body-guard of the empire of mind. Even in the weak human memory they survive so long, as saints, as heroes, as gods; they alone surviving: peopling, they alone, the immeasured solitudes of Time! To thee Heaven, though severe, is *not* unkind; Heaven is kind—as a noble mother; as that Spartan mother, saying while she gave her son his shield, “WITH IT, MY SON, OR UPON IT!” Thou, too, shalt return *home*, in honor to thy far-distant home, in honor; doubt it not—if in the battle thou keep thy shield! Thou, in the eternities and deepest death-kingdoms, art not an alien; thou every where art a denizen! Complain not; the very Spartans did not complain.

THOMAS CARLYLE.

LESSON III.—THE DUTY OF LABOR.

1. LABOR is man's great function. The earth and the atmosphere are his laboratory. With spade and plow, with mining shafts, and furnaces, and forges, with fire and steam, amid the

noise and whirl of swift and bright machinery, and abroad in the silent fields, beneath the roofing sky, man was made to be ever working, ever experimenting. And while he and all his dwellings of care and toil are borne onward with the circling skies, and the shows of heaven are around him, and their infinite depths image and invite his thought, still in all the worlds of philosophy, in the universe of intellect, man must be a worker. He is nothing, he can be nothing, he can achieve nothing, fulfill nothing, without working.

2. Not only can he gain no lofty improvement without this, but without it he can gain no tolerable happiness. So that he who gives himself up to utter indolence finds it too hard for him, and is obliged in self-defense, unless he be an idiot, to do something. The miserable victims of idleness and ennui, driven at last from their chosen resort, are compelled to work, to do something; yes, to employ their wretched and worthless lives in—"killing time." They must hunt down the hours as their prey. Yes, time, that mere abstraction, that sinks light as the air upon the eyelids of the busy and the weary, to the idle is an enemy, clothed with gigantic armor; and they must kill it, or themselves die. They can not live in mere idleness; and all the difference between them and others is, that they employ their activity to no useful end. They find, indeed, that the hardest work in the world is to do nothing.—DEWEY.

LESSON IV.—WORK AWAY.

1. **Work away!**
 For the master's eye is on us,
 Never off us, still upon us,
 Night and day.
 Work away!
 Keep the busy fingers plying,
 Keep the ceaseless shuttles flying;
 See that never thread lie wrong;
 Let not clash or clatter round us,
 Sound of whirring wheels confound us;
 Steady hand! let woof be strong
 And firm, that has to last so long!
 Work away!
2. Keep upon the anvil ringing
 Stroke of hammer; on the gloom
 Set 'twixt cradle and 'twixt tomb
 Shower of fiery sparkles flinging;
 Keep the mighty furnace glowing;
 Keep the red ore hissing, flowing

Swift within the ready mould;
 See that each one than the old
 Still be fitter, still be fairer
 For the servant's use, and rarer
 For the master to behold:

Work away!

3. Work away!

For the leader's eye is on us,
 Never off us, still upon us,
 Night and day.

Wide the trackless prairies round us,
 Dark and unsunned woods surround us,
 Deep and savage mountains bound us;

Far away

Smile the soft savannas green,
 Rivers sweep and roll between:

Work away!

4. Bring your axes, woodmen true;

Smite the forest till the blue
 Of heaven's sunny eye looks through
 Every wild and tangled glade;
 Jungled swamp and thicket shade

Give to-day!

O'er the torrents fling your bridges,
 Pioneers! Upon the ridges

Widen, smooth the rocky stair—

They that follow, far behind

Coming after us, will find

Surer, easier footing there;

Heart to heart, and hand to hand,

From the dawn to dusk o' day,

Work away!

Scouts upon the mountain's peak—

Ye that see the Promised Land,

Hearten us! for ye can speak

Of the country ye have scanned,

Far away!

5. Work away!

For the Father's eye is on us,

Never off us, still upon us,

Night and day.

WORK AND PRAY!

Pray! and work will be completer;

Work! and prayer will be the sweeter;

Love! and prayer and work the fleetest

Will ascend upon their way.

Fear not lest the busy finger

Weave a net the soul to stay;

Give her wings—she will not linger;

Soaring to the source of day;

Cleaving clouds that still divide us

From the azure depths of rest,

She will come again! beside us,

With the sunshine on her breast,
 Sit, and sing to us, while quickest
 On their task the fingers move,
 While the outward din wars thickest,
 Songs that she hath learned above.

6. Live in Future as in Present;
 Work for both while yet the day
 Is our own! for lord and peasant,
 Long and bright as summer's day,
 Cometh, yet more sure, more pleasant,
 Cometh soon our holiday;
 Work away!

LESSON V.—NEVER DESPAIR.

THE opal-hued and many-perfumed morn
 From gloom is born;
 From out the sullen depth of ebon Night
 The stars shed light;
 Gems in the rayless caverns of the earth
 Have their slow birth;
 From wondrous alchemy of winter hours
 Come summer flowers;
 The bitter waters of the restless main
 Give gentle rain;
 The fading bloom and dry seed bring once more
 The year's fresh store;
 Just sequences of clashing tones afford
 The full accord;
 Through weary ages, full of strife and ruth,
 Thought reaches Truth;
 Through efforts, long in vain, prophetic need
 Begets the deed:
 Nerve then thy soul with direst need to cope;
 Life's brightest hope
 Lies latent in Fate's deadliest lair—
 Never despair!—*Anonymous.*

LESSON VI.—GOD IS EVERY WHERE.

1. Oh! show me where is He,
 The high and holy One,
 To whom thou bend'st the knee,
 And pray'st, "Thy will be done!"
 I hear' thy song of praise',
 And lo! no *form*' is near:
 Thine *eyes* I see thee raise',
 But where doth God appear'?

Oh! teach me who *is*' God, and where his glories shine',
 That I may kneel and pray, and call *thy* Father *mine*.

2. "Gaze on that arch above';
 The glittering vault admire'.
Who taught those orbs to move'?
Who lit their ceaseless fire'?
Who guides the moon to run
 In silence through the skies'?
Who bids that dawning sun
 In strength and beauty rise'?

There view immensity'! behold! my God is there:
 The sun', the moon', the stars', his majesty declare'.

3. "See where the *mountains*' rise;
 Where thundering *torrents*' foam;
 Where, veil'd in towering skies',
 The *eagle*' makes his home;
 Where savage nature dwells,
 My God is present too';
 Through all his wildest dells
 His footsteps I pursue:

He rear'd those giant cliffs', supplies that dashing stream',
 Provides the daily food which stills the wild bird's scream.

4. "Look on that world of *waves*,
 Where finny nations glide;
 Within whose deep, dark caves
 The ocean-monsters hide:
His power is sovereign there,
 To raise', to quell' the storm;
 The *depths* his bounty share,
 Where sport the scaly swarm:

Tempest and calms obey the same almighty voice
 Which rules the earth and skies, and bids far worlds rejoice.

5. "No human thoughts can soar
 Beyond his boundless might;
He swells the thunder's roar,
He spreads the wings of night.
 Oh! praise his works divine'!
 Bow down thy soul in prayer';
 Nor ask for other sign
 That God is every where:

The viewless Spirit'! He—immortal', holy', blest':
 Oh! worship him in faith', and find eternal rest'!"—*Anonymous.*

PATERNAL AFFECTION.

Some feelings are to mortals given,
 With less of earth in them than heaven;
 And if there be a human tear
 From passion's dross refined and clear,
 A tear so limpid and so meek
 It would not stain an angel's cheek,
 'Tis that which pious fathers shed
 Upon a dutious daughter's head.—SCOTT.

PART XI.

HISTORICAL. ANCIENT HISTORY PRIOR TO
THE CHRISTIAN ERA.

LESSON I.—EARLY GRECIAN HISTORY.

1. NEARLY all that is of interest and importance to us in the history of the world prior to the Christian era is embraced in the history of the Jews, and in Grecian and Roman history. To the Bible, chiefly, we are to look for the details of the former. Grecian history follows next in the order of time, beginning far back in the gloom of antiquity, with the supposed founding of Argos in the year 1856 before the Christian era, and extending down to the conquest of Greece by the Romans in the year 146 B.C. After this latter period, and during several centuries, the history of the then known world is absorbed in the overshadowing of, first, the Roman republic, and, afterward, of the Roman empire.

2. All that is known of Grecian history during a period of more than a thousand years after the date arbitrarily assigned

for the founding of Argos, rests on no better basis than the songs and traditionary legends of bards and story-tellers. During this long period it is impossible to distinguish names and events, real and historical, from fictitious creations which so confound the human and the divine as to mock all attempts at elucidation. We must therefore set aside as merely pleasing fictions, to be classed with the legends of the gods, the stories of Ce'crop's, and Cran'aus, and Dan'aus, the account of the Argonautic expedition, and the labors of Hercules; and even the beautiful story of Helen and the Trojan war, "the most splendid gem in the Grecian legends," is declared by the historian Grote to be "essentially a legend, and nothing more."

3. But out of this thousand years of darkness a something tangible and reliable has, nevertheless, been obtained, which may be dignified with the name of history—a history of what the people *thought*, though not of what they *did*. From fable, and legend, and tradition, we learn what was the religious belief of the early Greeks, and this has been embodied in what is called *Grecian mythology*.

4. The early Greeks, like all rude, uncultivated tribes, probably associated their earliest religious emotions with the character of surrounding objects, and ascribed its appropriate deity to every manifestation of power in the visible universe. Thus they had nymphs of the forests, rivers, meadows, and fountains, and gods and goddesses almost innumerable, some terrestrial, others celestial, according to the places over which they were supposed to preside, and rising in importance in proportion to the power they manifested. The foundation of this religion, like all others, was a belief in higher existences which have an influence over the destinies of mortals. The process by which the beings of Grecian mythology naturally arose out of the teeming fancies of the ardent Greek mind, is beautifully described by Wordsworth in the following lines.

LESSON II.—GRECIAN MYTHOLOGY.

1. IN that fair clime, the lonely herdsman, stretched
On the soft grass through half a summer's day,
With music lulled his indolent repose;
And in some fit of weariness, if he,
When his own breath was silent, chanced to hear
A distant strain, far sweeter than the sounds

Which his poor skill could make, his fancy fetch'd
Even from the blazing chariot of the sun
A beardless youth,* who touched a golden lute,
And filled the illumined groves with ravishment.

2. The nightly hunter, lifting a bright eye
Up toward the crescent moon, with grateful heart
Called on the lovely wanderer who bestow'd
That timely light to share his joyous sport.
And hence a beaming goddess,† with her nymphs,
Across the lawn, and through the darksome grove
(Not unaccompanied with tuneful notes
By echo multiplied from rock or cave),
Swept in the storm of chase, as moon and stars
Glance rapidly along the clouded heaven
When winds are blowing strong. The traveler slaked
His thirst from rill or gushing fount, and thank'd
The Naiad.‡ Sunbeams, upon distant hills
Gliding apace, with shadows in their train,
Might, with small help from fancy, be transformed
Into fleet Oreads§ sporting visibly.
3. The Zephyrs fanning, as they passed, their wings,
Lacked not for love fair objects, whom they wooed
With gentle whisper.|| Withered boughs grotesque,
Stripped of their leaves and twigs by hoary age,
From depth of shaggy covert peeping forth
In the low vale, or on steep mountain side;
And sometimes intermixed with stirring horns
Of the live deer, or goat's depending beard—
These were the lurking satyrs,¶ a wild brood
Of gamesome deities; or Pan himself,
The simple shepherd's awe-inspiring God.**—WORDSWORTH.

LESSON III.—THE PERSIAN WARS.

1. PASSING over the “fabulous period” of Grecian history, which may be supposed to end about the time of the close of the supposed Trojan war, and the “uncertain period,”

* This is *Apollo*, or the sun, the god of prophecy, archery, and music, represented as a youth in the perfection of manly strength and beauty. He bears a lyre in his hand, sometimes a bow, and a golden lute, with a golden quiver of arrows at his back.

† *Diana*, the exact counterpart of her brother *Apollo*, was queen of the woods, and the goddess of hunting. *Diana* is one of the names under which the moon was worshiped.

‡ The *Naiads* are represented as young and beautiful nymphs, who presided over rivers, brooks, springs, and fountains.

§ The *Oreads*, nymphs of the mountains, generally attended upon *Diana*, and accompanied her in hunting.

|| The *Zephyrs* were the genial west winds. They were brothers of the stars, and seldom visited the earth except during the shades of evening.

¶ The *Satyrs* were represented like men, but with feet and legs of goats, short horns on the head, and the whole body covered with thick hair.

** The horned and goat-footed *Pan* was the god of shepherds, and lord of the woods and mountains. What are called *panic* terrors were ascribed to Pan; as loud noises, whose causes could not easily be traced, were oftenest heard in mountainous regions, which were his favorite haunts.

which embraces an account of the institutions of Lycurgus, the Messenian wars, and the legislation of Solon, we come down to what is called the "authentic period," which begins with the causes that led to the first Persian war.

2. Dari'us, king of Persia, exasperated against Athens on account of the assistance which she had given to the Greek colonies of Asia Minor in their revolt against the Persian power, resolved upon the conquest of all Greece; but in the third year of the war, 490 B.C., his army, numbering a hundred thousand men, was defeated with great slaughter by a force of little more than ten thousand Greeks on the plains of Marathon.

3. Ten years later, Xerxes, the son and successor of Dari'us, opened the second Persian war by invading Greece in person, at the head of the greatest army the world has ever seen, and whose numbers have been estimated at more than two millions of fighting men. This immense host, proceeding by the way of Thessaly, had arrived without opposition at the narrow defile of Thermopylæ, between the mountains and the sea, where the Spartan Leonidas was posted with three hundred of his countrymen and some Thespian allies, in all less than a thousand men.

4. The Spartans were forbidden by their laws ever to flee from an enemy; they had taken an oath never to desert their standards; and Leonidas and his countrymen, and their few allies, prepared to sell their lives as dearly as possible. Bravely meeting the attack of the Persian host, and retreating into the narrowest of the pass as their numbers were thinned by the storm of arrows, and by the living mass that was hurled upon them, they fought with the valor of desperation until every one of their number had fallen.* A monument was afterward erected on the spot, bearing the following inscription: "Go, stranger, and tell at Lacedæmon that we died here in obedience to her laws."

* The story that Leonidas made a night attack, and penetrated nearly to the royal tent, as described by Croly in his well-known poem beginning,

"It was the wild midnight; a storm was on the sky,"

is a mere fiction, opposed to well-known history. For this reason we have not introduced it in our selections. The attack was commenced in the forenoon, and by the Persians. Historical fictions may be introduced without any impropriety where they fill up with *probable* events the gaps in history, but not where they are in *opposition* to history. Of the former character are most of the historical scenes in Shakspeare.

LESSON IV.—ADDRESS OF LEONIDAS TO THE SPARTANS.

1. "WHY this astonishment on every face,
Ye men of Sparta? Does the name of death
Create this fear and wonder? Oh my friends!
Why do we labor through the arduous paths
Which lead to virtue? Fruitless were the toil,
Above the reach of human feet were placed
The distant summit, if the fear of death
Could intercept our passage. But in vain
His blackest frowns and terrors he assumes
To shake the firmness of the mind which knows
That, wanting virtue, life is pain and woe;
That, wanting liberty, even virtue mourns,
And looks around for happiness in vain.
 2. "Then speak, oh Sparta! and demand my life;
My heart, exulting, answers to thy call,
And smiles on glorious fate. To live with fame
Is allowed to the many; but to die
With equal lustre is a blessing Heaven
Selects from all the choicest boons of fate,
And with a sparing hand on few bestows."
Salvation thus to Sparta he proclaimed.
Joy, rapt a while in admiration, paused,
Suspending praise; nor praise at last resounds
In high acclaim to rend the arch of heaven;
A reverential murmur breathes applause.—RICH. GLOVER.
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LESSON V.—THE SPARTANS NOBLY KEPT THEIR OATH.

1. 'Twas an hour of fearful issues,
When the bold three hundred stood,
For their love of holy freedom,
By that old Thessalian flood—
When, lifting high each sword of flame,
They called on every sacred name,
And swore, beside those dashing waves,
They never, never would be slaves!
2. And oh! that oath was nobly kept.
From morn to setting sun
Did desperation urge the fight
Which valor had begun;
Till, torrent-like, the stream of blood
Ran down and mingled with the flood,
And all, from mountain cliff to wave,
Was Freedom's, Valor's, Glory's grave.
3. Oh yes! that oath was nobly kept,
Which nobly had been sworn,
And proudly did each gallant heart
The foeman's fetters spurn;

- Gave his high charge : " Soon as yon sun shall cease
 To dart his radiant beams, and dark'ning night
 Ascends the temple of the sky, arrange
 In three divisions your well-ordered ships,
 And guard each pass, each outlet of the seas :
 Others enring around this rocky isle
 Of Salamis. Should Greece escape her fate,
 And work her way by secret flight, your heads
 Shall answer the neglect." This harsh command
 He gave, exulting in his mind, nor knew
 What Fate designed. With martial discipline
 And prompt obedience, snatching a repast,
 Each mariner fixed well his ready oar.
2. Soon as the golden sun was set, and night
 Advanced, each, trained to ply the dashing oar,
 Assumed his seat ; in arms each warrior stood,
 Troop cheering troop through all the ships of war.
 Each to the appointed station steers his course,
 And through the night his naval force each chief
 Fix'd to secure the passes. Night advanced,
 But not by secret flight did Greece attempt
 To escape. The morn, all beauteous to behold,
 Drawn by white steeds, bounds o'er the enlighten'd earth :
 3. At once from every Greek, with glad acclaim,
 Burst forth the song of war, whose lofty notes
 The echo of the island rocks returned,
 Spreading dismay through Persia's host, thus fallen
 From their high hopes ; no flight this solemn strain
 Portended, but deliberate valor bent
 On daring battle ; while the trumpet's sound
 Kindled the flames of war. But when their oars
 (The pæan ended) with impetuous force
 Dash'd the surrounding surges, instant all
 Rush'd on in view ; in orderly array
 The squadron of the right first led, behind
 Rode their whole fleet ; and now distinct was heard
 From every part this voice of exhortation :
 4. " Advance, ye sons of Greece, from thralldom save
 Your country—save your wives, your children save,
 The temples of your gods, the sacred tomb
 Where rest your honor'd ancestors ; this day
 The common cause of all demands your valor."
 Meantime from Persia's hosts the deep'ning shout
 Answer'd their shout ; no time for cold delay ;
 But ship 'gainst ship its brazen beak impell'd.
 5. First to the charge a Grecian galley rush'd ;
 Ill the Phœnician bore the rough attack,
 Its sculptured prow all shatter'd. Each advanced,
 Daring an opposite. The deep array
 Of Persia at the first sustain'd the encounter ;
 But their throng'd numbers, in the narrow seas
 Confined, want room for action ; and, deprived
 Of mutual aid, beaks clash with beaks, and each

And Xerxes, in a single bark,
Where late his thousand ships were dark,
Must all their fury dare.
What a revenge—a trophy, this—
For thee, immortal Sal'amis!—MRS. JEWSBURY.

LESSON VIII.—BATTLE OF PLATÆ'A, 479 B.C.:—END OF
THE PERSIAN WARS.

BULWER'S *Athens*.

1. AFTER the defeat of the Persians in the naval battle of Sal'amis, their army, which remained in Greece under the command of Mardonius, experienced a final overthrow in the battle of Platæ'a. In this famous battle the Spartan general Pausanias had the chief command of the Grecian forces. We give the leading incidents of the battle as graphically described by Bulwer:

2. "As the troops of Mardonius advanced, the rest of the Persian armament, deeming the task was not now to fight, but to pursue, raised their standards and poured forward tumultuously, without discipline or order. Pausanias, pressed by the Persian line, lost no time in sending to the Athenians for succor. But when the latter were on their march with the required aid, they were suddenly intercepted by the Greeks in the Persian service, and cut off from the rescue of the Spartans.

3. "The Spartans beheld themselves thus unsupported with considerable alarm. Committing himself to the gods, Pausanias ordained a solemn sacrifice, his whole army awaiting the result, while the shafts of the Persian bowmen poured on them near and fast. But the entrails presented discouraging omens, and the sacrifice was again renewed. Meanwhile the Spartans evinced their characteristic fortitude and discipline—not one man stirring from his ranks until the auguries should assume a more favoring aspect; all harassed, and some wounded by the Persian arrows, they yet, seeking protection only beneath their broad bucklers, waited with a stern patience the time of their leader and of Heaven. Then fell Callic'rates, the stateliest and strongest soldier in the whole army, lamenting, not death, but that his sword was as yet undrawn against the invader.

4. "And still sacrifice after sacrifice seemed to forbid the battle, when Pausanias, lifting his eyes, that streamed with tears, to the temple of Juno that stood hard by, supplicated

the goddess that if the fates forbade the Greeks to conquer, they might at least fall like warriors. And while uttering this prayer the tokens waited for became suddenly visible in the victims, and the augurs announced the promise of coming victory. Therewith the order of battle ran instantly through the army, and, to use the poetical comparison of Plutarch, the Spartan phalanx suddenly stood forth in its strength, like some fierce animal—erecting its bristles, and preparing its vengeance for the foe. The ground, broken in many steep and precipitous ridges, and intersected by the Aso'pus, whose sluggish stream winds over a broad and rushy bed, was unfavorable to the movements of cavalry, and the Persian foot advanced therefore on the Greeks.

5. "Drawn up in their massive phalanx, the Lacedæmonians presented an almost impenetrable body—sweeping slowly on, compact and serried—while the hot and undisciplined valor of the Persians, more fortunate in the skirmish than the battle, broke itself in a thousand waves upon that moving rock. Pouring on in small numbers at a time, they fell fast round the progress of the Greeks—their armor slight against the strong pikes of Sparta—their courage without skill—their numbers without discipline; still they fought gallantly, even when on the ground seizing the pikes with their naked hands, and with the wonderful agility which still characterizes the Oriental swordsmen, springing to their feet and regaining their arms when seemingly overcome, wresting away their enemies' shields, and grappling with them desperately hand to hand.

6. "Foremost of a band of a thousand chosen Persians, conspicuous by his white charger, and still more by his daring valor, rode Mardonius, directing the attack—fiercer wherever his armor blazed. Inspired by his presence, the Persians fought worthily of their warlike fame, and, even in falling, thinned the Spartan ranks. At length the rash but gallant leader of the Asiatic armies received a mortal wound—his skull was crushed in by a stone from the hand of a Spartan. His chosen band, the boast of the army, fell fighting around him, but his death was the general signal of defeat and flight. Encumbered by their long robes, and pressed by the relentless conquerors, the Persians fled in disorder toward their camp, which was secured by wooden intrenchments, by gates, and towers, and walls. Here, fortifying themselves as they best might, they contended with advantage against the Lacedæmonians, who were ill skilled in assault and siege.

7. "Meanwhile the Athenians obtained the victory on the plains over the Greeks of Mardonius, and now joined the Spartans at the camp. The Athenians are said to have been better skilled in the art of siege than the Spartans; yet at that time their experience could scarcely have been greater. The Athenians were at all times, however, of a more impetuous temper; and the men who had 'run to the charge' at Marathon were not to be baffled by the desperate remnant of their ancient foe. They scaled the walls—they effected a breach through which the Tegeans were the first to rush—the Greeks poured fast and fierce into the camp. Appalled, dismayed, stupefied by the suddenness and greatness of their loss, the Persians no longer sustained their fame—they dispersed in all directions, falling, as they fled, with a prodigious slaughter, so that out of that mighty armament scarce three thousand effected an escape."

8. Another writer remarks that "the treasure found in the camp of the Persians on this occasion was immense: the furniture of the tents glittered with gold and silver; and vessels of the same metals were seen scattered about for ordinary use, and piled up in wagons." "Pausanias, when he entered the tent of Mardonius, and saw the rich hangings, the soft carpets, the couches and tables shining with gold and silver, ordered the Persian slaves to prepare a banquet, such as they were used to set out for their master. When it was spread he bade his helots set by its side the simple fare of his own ordinary meal, and then invited the Greek officers to mark the folly of the barbarian who, with such instruments of luxury at his command, had come to rob the Greeks of their scanty store."

9. When the deluge of the Persian wars rolled back to its Eastern bed, and the world was once more comparatively at rest, the continent of Greece rose visibly and majestically above the rest of the civilized earth. Then began what has been called the "Age of Pericles," the era of Athenian greatness, which has been briefly described in a previous article,* but to which we again refer for the purpose of giving the following beautiful extract descriptive of the glories and greatness of Athens during that period:

10. "Nowhere else," remarks Alison, "is to be found a state so small in its origin, and yet so great in its progress; so contracted in its territory, and yet so gigantic in its achievements; so limited in numbers, and yet so immortal in genius."

* See the Part on Architecture, page 235.

Its dominions on the continent of Greece did not exceed an English county; its free inhabitants never amounted to thirty thousand citizens, and yet these inconsiderable numbers have filled the world with their renown: poetry, philosophy, architecture, sculpture, tragedy, comedy, geometry, physics, history, politics, almost date their origin from Athenian genius; and the monuments of art with which they have overspread the world still form the standard of taste in every civilized nation on earth."

LESSON IX.—THE ERA OF GRECIAN ELOQUENCE AND LITERATURE.

1. THE golden age of Grecian eloquence and literature is embodied in a period of a hundred and thirty years, reckoning from the time of Pericles; and during this period Athens bore the palm alone. Of the many eminent Athenian orators, the most distinguished were Ly'sias, Isoc'ratēs, Æs'chinēs, and Demos'thenēs. Among historians whose works are still venerated may be mentioned, as most conspicuous, the names of Herod'otus, Thucyd'idēs, Xen'ophon, and Polyb'ius; among poets and dramatists, Æs'chylus,* Soph'oclēs, Eurip'idēs, and Aristoph'anēs; and among philosophers, Soc'ratēs, Plā'to, and Aristot'le. Volumes would be requisite to describe the character and works of these writers, and to convey a just idea of the indebtedness of the moderns to the lights which they kindled.

2. The Greeks were exceedingly fond of the drama, which we may now look back upon as one of the best expositors of the Athenian mind in the departments of politics, religion, and philosophy. In the time of Pericles a large number of dramas was presented on the Athenian stage every year; the whole population of Athens flocked to the theatres to witness them; and when we reflect that these representations embraced not only, as at first, the religious notions of the Greeks, but that they were finally extended to every subject of political and private life, we shall be satisfied that so powerful poetic influences were never brought to act upon any other people.

3. Of the very great degree of license which was given to

* Æs'chylus fought in the battle of Marathon, and also in that of Sal'amis. From one of his tragedies, entitled "*The Persians*," we have given an extract descriptive of the naval battle of Sal'amis. See page 502.

the Grecian drama in attacking, under the veil of satire, existing institutions, politicians, philosophers, poets, and even private citizens by name, some idea may be formed from the following extract from "*The Knights*" of Aristoph'anēs, in which a *chorus* of singers, coming upon the stage, thus commences an attack upon Cleon, a corrupt political demagogue who had gained such consideration by flattering the lower orders and railing at the higher, that he stood in the situation of head of a party.

THE POLITICAL DEMAGOGUE.

Scene : the public market-place of Athens.

Chorus.

Close around him, and confound him, the confounder of us all ;
Pelt him, pummel him, and maul him ; rummage, ransack, overhaul him ;
Overbear him and outbawl him ; bear him down, and bring him under.
Bellow like a burst of thunder, 'Robber' ! harpy' ! sink of plunder' !
Rogue and villain' ! rogue and cheat' ! rogue and villain, I repeat' !
Oftener than I can repeat it, has the rogue and villain cheated.
Close around him, left and right, spit upon him, spurn and smite :
Spit upon him as you see ; spurn and spit at him like me.
But beware, or he'll evade you, for he knows the private track
Where Eu'crates was seen escaping with his mill-dust on his back.

Cleon.

Worthy veterans of the jury, you that, either right or wrong,
With my threepenny provision I've maintained and cherished long,
Come to my aid ! I'm here waylaid—assassinated and betrayed.

Chorus.

Rightly served' ! we serve you rightly, for your hungry love of pelf ;
For your gross and greedy rapine, gormandizing by yourself ;
You that, ere the figs are gathered, pilfer with a privy twitch
Fat delinquents and defaulters, pulpy, luscious, plump, and rich ;
Pinching, fingering, and pulling—tempering, selecting, culling,
With a nice survey discerning which are green and which are turning,
Which are ripe for accusation, forfeiture, and confiscation.

Him, besides, the wealthy man, retired upon an easy rent,
Hating and avoiding party, noble-minded, indolent,
Fearful of official snares, intrigues, and intricate affairs ;
Him you mark ; you fix and hook him, while he's gaping unawares ;
At a fling, at once you bring him hither from the Chersonese,
Down you cast him, roast and baste him, and devour him at your ease.

Cleon.

Yes' ! assault' , insult' , abuse' me ! this is the return I find
For the noble testimony, the memorial I designed :
Meaning to propose proposals for a monument of stone,
On the which your late achievements should be carved and neatly done.

Chorus.

Out, away' with him ! the slave' ! the pompous, empty, fawning knave' !

He nears—he reaches—they are side by side;
 Now one—now th' other—by a length the victor.
 The courses all are past—the wheels erect—
 All safe—when, as the hurrying coursers round
 The fatal pillar dashed, the wretched boy
 Slackened the *left* rein. On the column's edge
 Crashed the frail axle—headlong from the car,
 Caught and all mesh'd within the reins, he fell;
 And, masterless, the mad steeds raged along!

4. Loud from that mighty multitude arose
 A shriek—a shout! But yesterday such deeds—
 To-day such doom! Now whirled upon the earth;
 Now his limbs dashed aloft, they dragged him—those
 Wild horses—till, all gory, from the wheels
 Released—and no man, not his nearest friends,
 Could in that mangled corpse have traced Orestes.
 They laid the body on the funeral pyre,
 And while we speak, the Phocian strangers bear,
 In a small, brazen, melancholy urn,
 That handful of cold ashes to which all
 The grandeur of the beautiful hath shrunk.
 Within they bore him—in his father's land
 To find that heritage—a tomb.

¹ *ATE* (pronounced ā), always; ever. [Used in this sense only in poetry.]

LESSON XI.—THE LATTER DAYS OF GRECIAN HISTORY.

1. ABOUT fifty years after the battle of Plataæ'a the Grecians became involved in a series of domestic contests, called the "Peloponnesian Wars," which continued, with occasional intervals of peace, until Philip, king of Macedon, by the successful battle of Chærone'a, broke up the feeble Grecian confederacy, and soon after succeeded in inducing the conquered states to elect him commander-in-chief of all the Grecian forces. It was while Philip was plotting against the liberties of Greece that his intrigues called forth from the Athenian Demosthenes, the greatest of Grecian orators, those famous "*Philippics*" which have immortalized both the orator and the object of his invectives.

2. Alexander the Great, the son and successor of Philip, carried out the plans of his father by a successful invasion of the Persian dominions; but on his death, in the thirty-third year of his age (B.C. 324), the vast empire which he had so suddenly built up was as suddenly broken in pieces, and the Grecian states again became a prey to civil dissensions, which were terminated only by the subjugation of all Greece to the dominion of the Romans, in the year 146 before the Christian

era. This point is the proper termination of Grecian history; for, "as rivers flow into the sea, so does the history of all the nations known to have existed previously in the regions round the Mediterranean, terminate in the history of Rome."

3. With the loss of her liberties the glory of Greece passed away. Her population had been gradually diminishing since the period of the Persian wars; and from the epoch of the Roman conquest the spirit of the nation sunk into despondency, and the energies of the people gradually wasted, until, at the time of the Christian era, Greece existed only in the remembrance of the past. Then, many of her cities were desolate, or had sunk to insignificant villages, while Athens alone maintained her renown for philosophy and the arts, and became the instructor of her conquerors; large tracts of land, once devoted to tillage, were either barren, or had been converted into pastures for sheep and vast herds of cattle; while the rapacity of Roman governors had inflicted upon the sparse population impoverishment and ruin.

LESSON XII.—EARLY ROMAN HISTORY.

1. THE early history of Rome, as recorded by Livy and other early writers, from the period of the supposed founding of the city by Romulus, about the year 753 B.C., down to the banishment of the Tarquins and the abolition of royalty, 510 B.C.—and even perhaps a century or two later—is of very doubtful authenticity, and was probably compiled from legendary poems that had been transmitted from generation to generation, and often rehearsed, to the sound of music, at the banquets of the great.

2. The historian Macaulay has aimed to reconstruct some of these poetic legends, which he has given to the world under the title of "Lays of Ancient Rome," and which are supposed to have been recited by ancient minstrels who were in no wise above the passions and prejudices of their age and country. It is stated by all the Latin historians that, a few years after the expulsion of the Tarquins for their despotism and crimes, the neighboring Etruscans, to which nation they belonged, endeavored to restore the tyrants to power, and came against Rome with an overwhelming force. The Romans, repulsed at first, fled across a wooden bridge over the Tiber, when the Roman consul ordered the bridge to be destroyed, to prevent the enemy from entering the city. The

continuation of the legend is supposed to have been narrated by one of the Roman minstrels, as given in the following lesson, at a period one hundred years later than the events there recorded.

LESSON XIII.—THE STORY OF HORATIUS.

1. But the consul's brow was sad,
And the consul's speech was low,
And darkly looked he at the wall,
And darkly at the foe.
“Their van will be upon us
Before the bridge goes down;
And if they once may win the bridge,
What hope to save the town?”
2. Then out spoke brave Horatius,
The captain of the gate:
“To every man upon this earth
Death cometh soon or late,
And how can man die better
Than facing fearful odds
For the ashes of his fathers
And the temples of his gods?”
3. “Hew down the bridge, Sir Consul,
With all the speed ye may;
I, with two more to help me,
Will hold the foe in play.
In yon strait path a thousand
May well be stopped by three.
Now, who will stand on either hand,
And keep the bridge with me?”

Two brave Romans, Spurius Lartius and Herminius, responded to the call of their comrade; and the three, with arms in hand, sprang forward to defend the passage, while others hastened to cut away the props that supported the bridge.

4. Meanwhile the Tuscan army,
Right glorious to behold,
Came flashing back the noonday light,
Rank behind rank, like surges bright
Of a broad sea of gold.
Four hundred trumpets sounded
A peal of warlike glee,
As that great host, with measured tread,
And spears advanced, and ensigns spread,
Rolled slowly toward the bridge's head,
Where stood the dauntless three.

5. The three stood calm and silent,
And looked upon the foes,
And a great shout of laughter
From all the vanguard rose:
And forth three chiefs came spurring
Before that mighty mass;
To earth they sprang, their swords they drew,
And lifted high their shields, and flew
To win the narrow pass.

But the scorn and laughter of the Etruscans were soon changed to wrath and curses, for their chiefs were quickly laid low in the dust at the feet of the "dauntless three."

6. But now no sound of laughter
Was heard among the foes.
A wild and wrathful clamor
From all the vanguard rose.
Six spears' length from the entrance
Halted that mighty mass,
And for a space no man came forth
To win the narrow pass.
7. But hark! the cry is Astur:
And lo! the ranks divide,
And the great Lord of Luna
Comes with his stately stride.
Upon his ample shoulders
Clangs loud the fourfold shield,
And in his hand he shakes the brand
Which none but he can wield.

The proud Astur advances with a smile of contempt for the three Romans, and turns a look of scorn upon the flinching Tuscans.

8. Then, whirling up his broadsword
With both hands to the height,
He rushed against Horatius,
And smote with all his might.
With shield and blade Horatius
Right deftly turned the blow.
The blow, though turned, came yet too nigh;
It missed his helm, but gashed his thigh:
The Tuscans raised a joyful cry
To see the red blood flow.
9. He reeled, and on Herminius
He leaned one breathing-space;
Then, like a wild-cat mad with wounds,
Sprang right at Astur's face.
Through teeth, and skull, and helmet,
So fierce a thrust he sped,
The good sword stood a handbreadth out
Behind the Tuscan's head.

10. And the great Lord of Luna
Fell at that deadly stroke,
As falls on Mount Alvernus
A thunder-smitten oak.
Far o'er the crashing forest
The giant arms lie spread ;
And the pale augurs, muttering low,
Gaze on the blasted head.

In the mean time the axes had been busily plied ; and while the bridge was tottering to its fall, Lartius and Herminius regained the opposite bank in safety. Horatius remained facing the foe until the last timber had fallen, when, weighed down with armor as he was, he “plunged headlong in the tide.”

11. No sound of joy or sorrow
Was heard from either bank ;
But friends and foes, in dumb surprise,
With parted lips and straining eyes,
Stood gazing where he sank :
And when beneath the surges
They saw his crest appear,
All Rome sent forth a rapturous cry,
And even the ranks of Tuscany
Could scarce forbear to cheer.
12. But fiercely ran the current,
Swollen high by months of rain :
And fast his blood was flowing ;
And he was sore in pain,
And heavy with his armor,
And spent with changing blows ;
And oft they thought him sinking,
But still again he rose.
13. “Curse on him !” quoth false Sextus,
“Will not the villain drown ?
But for this stay, ere close of day
We should have sacked the town !”
“Heaven help him !” quoth Lars Porsenna,
“And bring him safe to shore ;
For such a gallant feat of arms
Was never seen before.”
14. And now he feels the bottom ;
Now on dry earth he stands ;
Now round him throng the fathers,
To press his gory hands ;
And now with shouts and clapping,
And noise of weeping loud,
He enters through the river-gate,
Borne by the joyous crowd.

Then follows an account of the rewards which a grateful people bestowed upon the hero. The minstrel thus concludes the legend :

15. When the good man mends his armor,
And trims his helmet's plume ;
When the good wife's shuttle merrily
Goes flashing through the loom ;
With weeping and with laughter
Still is the story told,
How well Horatius kept the bridge
In the brave days of old.—MACAULAY.
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LESSON XIV.—PATRICIAN AND PLEBEIAN CONTESTS.

1. DURING several hundred years after the overthrow of royalty, the history of the Roman republic is filled with accounts of the fierce civil contests which raged between the patrician aristocracy and the common people or plebeians, relieved by an occasional episode of a war with some of the surrounding people. At first, the patricians were the wealthy and ruling class ; they held all the high military commands ; they made the laws ; and they reduced the plebeians to a condition differing little from the most abject slavery.

2. At length, in the year 493 B.C., after an open rupture between these two classes, and the withdrawal of the plebeians from the city, a reconciliation was effected, and magistrates, called *tribunes*, were allowed to be chosen by the people to watch over their rights, and prevent abuses of authority. About forty-five years later, however, ten persons, called *decemvirs*, who were appointed to compile a body of laws for the commonwealth, having managed to get the powers of the government into their own hands, ruled in the most tyrannical manner, and oppressed the plebeians worse than ever.

3. But an unexpected event—a private injury—accomplished what wrongs of a more public nature had failed to effect. The wicked Appius Claudius, a leading decemvir, had formed the design of securing the person of the beautiful Virginia, daughter of Virginius ; but, finding her betrothed to another, in order to accomplish his purpose he procured a base dependent to claim her as his slave. As had been concerted, Virginia was brought before the tribunal of Appius himself, who ordered her to be surrendered to the claimant. It was then that the distracted father, having no other means of saving his daughter, stabbed her to the heart in the presence of the court and the assembled people. The people arose in their might ; the power of the “wicked ten” was overthrown ; and Appius, having been impeached, died in prison, probably by his own hand.

4. About eighty years after the death of Virginia, the plebeians succeeded, after a struggle of five years against every species of fraud and violence (especially on the part of Claudius Crassus, grandson of the infamous Appius Claudius), in obtaining a full acknowledgment of their rights, and all possible legal guarantees for their preservation. It is during this struggle that a popular poet (as Macaulay supposes), a zealous adherent of the tribunes, makes his appearance in the public market-place, and announces that he has a new song that will cut the Claudian family to the heart. He takes his stand on the spot where, according to tradition, Virginia, more than seventy years ago, was seized by the base dependent of Appius, and thus relates the story :

LESSON XV.—THE STORY OF VIRGINIA.

1. YE good men of the commons, with loving hearts and true,
Who stand by the bold tribunes that still have stood by you,
Come, make a circle round me, and mark my tale with care—
A tale of what Rome once hath borne, of what Rome yet may bear.
This is no Grecian fable, of fountains running wine,
Of maids with snaky tresses, or sailors turned to swine.
Here, in this very forum, under the noonday sun,
In sight of all the people, the bloody deed was done.
Old men still creep among us who saw that fearful day,
Just seventy years and seven ago, when the wicked ten bare sway.
2. Of all the wicked ten, still the names are held accursed,
And of all the wicked ten, Appius Claudius was the worst.
He stalked along the forum like King Tarquin in his pride;
Twelve axes waited on him, six marching on a side;
The townsmen shrank to right and left, and eyed askance with fear
His lowering brow, his curling mouth, which always seemed to sneer:
That brow of hate, that mouth of scorn, marks all the kindred still,
For never was there Claudius yet but wished the commons ill.
Nor lacks he fit attendance; for close behind his heels,
With outstretched chin and crouching pace, the client Marcus steals,
His loins girt up to run with speed, be the errand what it may,
And the smile flickering on his cheek, for aught his lord may say.
Where'er ye shed the honey, the buzzing flies will crowd;
Where'er ye fling the carrion, the raven's croak is loud;
Where'er down Tiber garbage floats, the greedy pike ye see;
And wheresoe'er such lord is found, such client still will be.

3. Then follows an account of the seizing of Virginia by Marcus as she was passing through the market-place, of the commotion among the people that was occasioned by it, and of the spirited but vain appeal which the young Icilius, the lover of Virginia, made to the people to rise and free them-

selves from the power of their oppressors. After a mock investigation, held by Appius in the Roman forum, or open market-place, a few days later, the tyrant was on the point of taking possession of the maiden, when her father, who had in the mean time come from the army to protect his child, begged permission to take leave of her, and speak a few words to her in private.

4. Straightway Virginius led the maid a little space aside,
To where the reeking shambles stood, piled up with horn and hide,
Close to yon low dark archway, where, in a crimson flood,
Leaps down to the great sewer the gurgling stream of blood.
Hard by, a flesher on a block had laid his whittle down :
Virginius caught the whittle up, and hid it in his gown.
And then his eyes grew very dim, and his throat began to swell,
And in a hoarse, changed voice, he spake, "Farewell, sweet child !
farewell !
5. Oh ! how I loved my darling ! Though stern I sometimes be,
To thee, thou know'st, I was not so. Who could be so to thee ?
And how my darling loved me ! How glad she was to hear
My footstep on the threshold when I came back last year !
And how she danced with pleasure to see my civic crown,
And took my sword, and hung it up, and brought me forth my gown !
Now, all those things are over—yes, all thy pretty ways,
Thy needle-work, thy prattle, thy snatches of old lays ;
And none will grieve when I go forth, or smile when I return,
Or watch beside the old man's bed, or weep upon his urn.
6. The house that was the happiest within the Roman walls,
The house that envied not the wealth of Capua's marble halls,
Now, for the brightness of thy smile, must have eternal gloom,
And for the music of thy voice, the silence of the tomb.
The time is come. See how he points his eager hand this way !
See how his eyes gloat on thy grief, like a kite's upon the prey !
With all his wit, he little deems that, spurned, betrayed, bereft,
Thy father hath in his despair one fearful refuge left.
He little deems that in this hand I clutch what still can save
Thy gentle youth from taunts and blows, the portion of the slave ;
Yea, and from nameless evil, that passeth taunt and blow—
Foul outrage which thou knowest not, which thou shalt never know.
Then clasp me round the neck once more, and give me one more kiss ;
And now, my own dear little girl, there is no way but this."
With that he lifted high the steel, and smote her in the side,
And in her blood she sank to earth, and with one sob she died.
7. Then, for a little moment, all people held their breath,
And through the crowded forum was stillness as of death ;
And in another moment brake forth from one and all
A cry as if the Volscians were coming o'er the wall.
Till, with white lips and bloodshot eyes, Virginius tottered nigh,
And stood before the judgment-seat, and held the knife on high,
"Oh, dwellers in the nether gloom, avengers of the slain,
By this dear blood I cry to you, do right between us twain ;

And even as Appius Claudius hath dealt by me and mine,
Deal you by Appius Claudius, and all the Claudian line!"
So spake the slayer of his child, and turned, and went his way;
But first he cast one haggard glance to where the body lay,
And writhed, and groaned a fearful groan, and then, with steadfast feet,
Strode right across the market-place unto the Sacred Street.

8. Then up sprang Appius Claudius: "Stop him, alive or dead!
Ten thousand pounds of copper to the man who brings his head!"
He looked upon his clients, but none would work his will;
He looked upon his lictors, but they trembled, and stood still.
And, as Virginius through the press his way in silence cleft,
Ever the mighty multitude fell back to right and left.
And he hath passed in safety unto his woeful home,
And there ta'en horse to tell the camp what deeds are done in Rome.

9. The people gathered around the dead body; and when Claudius attempted to disperse them, a furious onset was made upon the lictors, who were driven back severely wounded, and with garments torn in shreds. A rush was then made at Appius himself; but when the people could not reach him, owing to the crowd of his dependents who gathered around him, they resorted to other means of assault.

10. When stones began to fly,
He shook, and crouched, and wrung his hands, and smote upon his thigh.
"Kind clients, honest lictors, stand by me in this fray!
Must I be torn to pieces? Home—home the nearest way!"
While yet he spake, and looked around with a bewildered air,
Four sturdy lictors put their necks beneath the curule chair;
And fourscore clients on the left, and fourscore on the right,
Arrayed themselves with swords and staves, and loins girt up for fight.
But though without or staff or sword, so furious was the throng,
That scarce the train with might and main could bring their lord along.
11. Twelve times the crowd made at him; five times they seized his gown;
Small chance was his to rise again, if once they got him down;
And sharper came the pelting, and evermore the yell—
"Tribunes! we will have tribunes!"—rose with a louder swell:
And the chair tossed as tosses a bark with tattered sail,
When raves the Adriatic beneath an eastern gale;
When the Calabrian sea-marks are lost in clouds of spume,
And the great Thunder-Cape has donned his veil of inky gloom.
12. One stone hit Appius in the mouth, and one beneath the ear;
And, ere he reached Mount Palatine, he swooned with pain and fear.
His cursed head, that he was wont to hold so high with pride,
Now, like a drunken man's, hung down, and swayed from side to side:
And when his stout retainers had brought him to his door,
His face and neck were all one cake of filth and clotted gore.
As Appius Claudius was that day, so may his grandson be!
God send Rome one such other sight, and send me there to see.

LESSON XVI.—THE CARTHAGINIAN WARS.

1. AFTER the Romans had reduced all Italy to their dominion, about 270 years before the Christian era, they began to extend their influence abroad, when an interference with the affairs of Sicily brought on a war with Carthage, at that time a powerful republic on the northern African coast, superior in strength and resources to the Roman. The Carthaginians were originally a Tyrian colony from Phœnicia; and not only had they, at this time, extended their dominion over the surrounding African tribes, but they had foreign possessions in Spain, and also in Sicily, Sardinia, Corsica, Malta, and other islands of the Mediterranean.

2. In the year 263 before Christ the first Punic* war began; and, after it had continued eight years with varied success, the Romans sent the Consul Regulus, at the head of a large army, to carry the war into Africa. On the passage across the Mediterranean, the Carthaginian fleet, bearing not less than a hundred and fifty thousand men, was met and defeated; but in a subsequent battle on land the Romans themselves were defeated with great loss, and Regulus himself, being taken prisoner, was thrown into a dungeon. Five years later, however, the Carthaginians were in turn defeated in Sicily, with a loss of twenty thousand men, and the capture of more than a hundred of their elephants, which they had trained to fight in the ranks.

3. It was then that the Carthaginians sent an embassy to Rome with proposals of peace. Regulus was taken from his dungeon to accompany the embassy, the Carthaginians trusting that, weary of his long captivity, he would urge the senate to accept the proffered terms; but the inflexible Roman persuaded the senate to reject the proposal and continue the war, assuring his countrymen that the resources of Carthage were already nearly exhausted. Bound by his oath to return if peace were not concluded, he voluntarily went back, in spite of the prayers and entreaties of his friends, to meet the fate which awaited him. It is generally stated that after his return to Carthage he was tortured to death by the exasperated Carthaginians. The circumstances of the appearance of Regulus before the Roman senate, and his heroic self-sacrifice, are described in the following lesson.

* The term *Punic* means simply "Carthaginian." The three famous Carthaginian wars are usually called, in Roman history, "The Punic Wars."

LESSON XVII.—REGULUS BEFORE THE SENATE.

1. URGE me no more'; your prayers are vain';
 And even the tears ye shed':
 When I can lead to Rome again
 The bands that once I led';
 When I can raise your legions slain
 On swarthy Libya's fatal plain,
 To vengeance from the dead',
 Then will I seek once more a home,
 And lift a freeman's voice in Rome!
2. Accursed moment! when I woke
 From faintness all but death,
 And felt the coward conqueror's yoke
 Like venom'd serpents wreath
 Round every limb: if *lip* and *eye*
 Betrayed no sign of agony,
Inly I cursed my breath:
 Wherefore, of all that fought, was I
 The only wretch that could not die'?
3. To darkness and to chains consigned,
 The captive's fighting doom,
 I recked' not; could they chain the *mind*,
 Or plunge the *soul* in gloom'?
 And there they left me, dark and lone,
 Till darkness had familiar grown;
 Then from that living tomb
 They led me forth, I thought, to die';
 Oh! in that thought was ecstasy!
4. But no! kind Heaven had yet in store
 For me, a conquered slave,
 A joy I thought to feel no more,
 Or feel but in the grave.
 They deemed, perchance, my haughtier mood
 Was *quelled* by chains and solitude;
 That he who *once* was brave—
 Was I *not* brave'?—had now become
 Estranged from honor, as from Rome.
5. They bade me to my country bear
 The offers these have borne;
 They would have trained my lips to swear,
 Which never yet have sworn.
 Silent their base commands I heard,
 At length I pledged a Roman's word,
 Unshrinking, to return.
 I go, prepared to meet the worst,
 But I shall gall proud Carthage first.
6. They sue for peace; I bid you spurn
 The gilded bait they bear;
 I bid you still, with aspect stern,
 War—ceaseless war—declare.

- Fools as they were, could not mine eye,
Through their dissembled calmness, spy
The struggles of despair' ?
Else had they sent *this wasted frame*
To bribe you to your country's shame' ?
7. Your land—(I must not call it mine;
No country has the slave;
His father's name he must resign,
And even his father's grave—
But this not now)—beneath her lies
Proud Carthage and her destinies:
Her empire o'er the wave
Is yours; she knows it well, and you
Shall know, and make her *feel* it too.
8. Ay, bend your brows, ye ministers
Of coward hearts, on me;
Ye know no longer it is hers,
The empire of the sea;
Ye *know* her fleets are far and few,
Her bands, a *mercenary* crew;
And Rome, the bold and free,
Shall trample on her prostrate towers,
Despite your weak and wasted powers.
9. One path alone remains for me;
My vows were heard on high;
Thy triumphs, Rome, *I* shall not see,
For I return to die.
Then tell me not of hope or life;
I have in Rome no chaste, fond wife,
No smiling progeny;
One word concentrates for the slave—
Wife, children, country, *all*—THE GRAVE.—DALE.
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LESSON XVIII.—THE DOWNFALL OF CARTHAGE.

1. THE first Punic war ended disastrously to Carthage in the year 240 B.C. Twenty-two years later commenced the second Punic war, in which the Roman republic was at one time brought to the brink of ruin by the superior military skill of the Carthaginian Hannibal, who proved himself the greatest general of antiquity. Carrying the war into Italy, he penetrated nearly to the gates of Rome; but his army, enervated by the luxuries of the conquered cities, gradually dwindled away while victory already perched upon its banners.

2. Ere long Sicily was conquered by the Romans, the Carthaginian city of Syracuse being taken by storm after the siege had been a long time protracted by the mechanical skill

of the famous Archimē'des.¹ The youthful Scipio, who received the title of Africanus, also carried the war into Africa; Hannibal, recalled from Italy to protect Carthage, was defeated; and the second Punic war ended in the complete humiliation of Carthage (202 B.C.).

3. But still the very existence of a rival and neighboring republic was a thing which the Romans seem to have made up their minds not to endure; the expediency of a farther war with Carthage was a favorite topic of debate in the Roman senate; and it is said that, of the many speeches which the elder Cato made on this subject, all ended with the sentence, *delenda est Carthago*, "Carthage must be destroyed." And in a third and final war, unjustly provoked by the Romans, Carthage *was* destroyed; her walls being leveled with the ground, and the buildings of the city burned (146 B.C.). The same year witnessed the conquest of Greece—like Carthage, the victim of Roman ambition.

¹ AR-CHI-MĒ'-DĒS. See account of, p. 324.

LESSON XIX.—ADDRESS OF HANNIBAL TO HIS ARMY DURING THE SECOND CARTHAGINIAN WAR.

ON what side soever I turn my eyes, I behold all full of courage and strength. A veteran infantry; a most gallant cavalry: you, my allies, most faithful and valiant; you, Carthaginians, whom not only your country's cause, but the justest anger impels to battle. The hope, the courage of assailants, is always greater than of those who act upon the defensive. With hostile banners displayed you are come down upon Italy: you bring the war. Grief, injuries, indignities, fire your minds, and spur you forward to revenge. First, they demanded me—that I, your general, should be delivered up to them; next, of all you who had fought at the siege of Saguntum; and we were to be put to death by the extremest tortures. Proud and cruel nation! every thing must be yours, and at your disposal. You are to prescribe to us with whom we shall make war, with whom we shall make peace. You are to set us bounds; to shut us up within hills and rivers; but you—you are not to observe the limits which yourselves have fixed! "Pass not the Iberus." What next? "Touch not the Saguntines; Saguntum is upon the Iberus; move not a step toward that city." Is it a small matter, then, that you have deprived us of our ancient possessions, Sicily

and Sardinia? you would have Spain too. Well, we shall yield Spain, and then—you will pass into Africa. Will pass, did I say? this very year they ordered one of their consuls into Africa, the other into Spain. No, soldiers; there is nothing left to us but what we can vindicate with our swords. Come on, then. Be men. The Romans may, with more safety, be cowards: they have their own country behind them, have places of refuge to fly to, and are secure from danger in the roads thither; but for you, there is no middle fortune between death and victory. Let this be but well fixed in your minds, and once again I say you are conquerors.

LESSON XX.—CONTINUATION OF ROMAN HISTORY.

1. A SHORT time after the conquest of Greece and the downfall of Carthage, the animosities which had long existed between the patricians and plebeians of Rome ripened into a civil war, known as the “dissensions of the Gracchi” (132 B.C.), in which the brothers Tiberius and Caius Gracchus, the noble defenders of the rights of the people, were slain. In the Germanic wars which soon followed, the Consul Ma’rius greatly distinguished himself, and saved Rome from destruction, for which the grateful people styled him the third founder of the city.

2. But again civil war broke out at Rome, the partisans of Sylla, a profligate Roman general, being arrayed against those of Ma’rius. The latter, being compelled to flee, after a series of romantic adventures escaped to Africa. Being landed at Carthage, the Roman governor of the district sent to inform him that unless he left Africa he should be treated as a public enemy. “Go and tell him,” replied the wanderer, “that you have seen the exile Ma’rius sitting on the ruins of Carthage.” There is a moral sublimity connected with this scene, which the pencil of the artist and the pen of the poet have often been called upon to portray.

MARIUS SEATED ON THE RUINS OF CARTHAGE.

3. Pillars are fallen at thy feet,
Fanes quiver in the air;
A prostrate city is thy seat,
And thou alone art there.
4. No change comes o’er thy noble brow,
Though ruin is around thee;
Thine eyebeam burns as proudly now,
As when the laurel crowned thee.

5. It can not bend thy lofty soul,
Though friends and fame depart;
The car of Fate may o'er thee roll,
Nor crush thy Roman heart.
6. And genius hath electric power,
Which earth can never tame;
Bright suns may scorch, and dark clouds lower,
Its flash is still the same.
7. The dreams we loved in early life
May melt like mist away;
High thoughts may seem, 'mid passions' strife,
Like Carthage in decay;
8. And proud hopes in the human heart
May be to ruin hurled,
Like mouldering monuments of art
Heaped on a sleeping world:
9. Yet there is something will not die,
Where life hath once been fair;
Some towering thoughts still rear on high;
Some Roman lingers there!—MRS. CHILD.

LESSON XXI.—ROMAN GLADIATORIAL COMBATS.

1. GLADIATORIAL combats among the Romans were originally exhibited at the graves of deceased persons. They thus formed a kind of funeral sacrifice, the shades of the dead being supposed to be propitiated with blood; but in process of time the magistrates and wealthy citizens gave shows of gladiators to entertain the people. The gladiators were composed mostly of captives and slaves, or of condemned malefactors. We read with horror the accounts of these barbarous and brutal gladiatorial exhibitions; and, were not the historical evidence irrefutable, we could hardly believe that in the city of Capua alone forty thousand gladiators were kept, and fed, and trained, to butcher each other for the gratification of the Roman people. Byron's picture of the dying gladiator is inimitably touching and beautiful.

THE DYING GLADIATOR.

2. I see before me the gladiator lie.
He leans upon his hand: his manly brow
Consents to death, but conquers agony,
And his drooped head sinks gradually low;
And through his side the last drops, ebbing slow
From the red gash, fall heavy, one by one,
Like the first of a thunder-shower; and now
The arena swims around him—he is gone,
Ere ceased the inhuman shout which hailed the wretch who won.

3. He heard it, but he heeded not: his eyes
Were with his heart, and that was far away:
He recked not of the life he lost, nor prize,
But where his rude hut by the Danube lay,
There were his young barbarians all at play,
There was their Dacian mother; he, their sire,
Butchered to make a Roman holiday:
All this rushed with his blood. Shall he expire,
And unavenged? Arise, ye Goths, and glut your ire.
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LESSON XXII.—THE REVOLT OF SPARTACUS, 72 B.C.

1. AFTER the death of both of the partisan leaders, Marius and Sylla, a powerful Marian faction still existed in the Roman province of Spain; and although the youthful Pompey, afterward surnamed the Great, and other noted generals, were sent to suppress it, it was several years before the rebellion was quelled. It was during the continuance of this war in Spain that a formidable revolt of the slaves, headed by Spartacus, a celebrated gladiator of Capua, broke out in Italy.

2. At first Spartacus and his companions formed a desperate band of robbers and murderers, but their numbers eventually increased to a hundred and twenty thousand men; and three prætorian and two consular armies were completely defeated by them. The war lasted more than two years, and at one time Rome itself was in danger; but the rebels, divided among themselves, were finally overcome, and nearly exterminated by the Prætor Crassus, the growing rival of Pompey. The circumstances of the revolt of Spartacus have been thus described:

3. "It had been a day of triumph in Capua. Lentulus, returning with victorious eagles, had amused the populace with the sports of the amphitheatre to an extent hitherto unknown even in that luxurious city. The shouts of revelry had died away; the roar of the lion had ceased; the last loiterer had retired from the banquet, and the lights in the palace of the victor were extinguished. The moon, piercing the tissue of fleecy clouds, silvered the dew-drops on the corselet of the Roman sentinel, and tipped the dark waters of the Volturnus with a wavy, tremulous light. No sound was heard save the last sob of some retiring wave, telling its story to the smooth pebbles of the beach; and then all was still as the breast when the spirit has departed. In the deep recesses of the amphitheatre a band of gladiators were assembled,

their muscles still knotted with the agony of conflict, the foam upon their lips, the scowl of battle yet lingering on their brows, when Spartacus, starting forth from amid the throng, thus addressed them :

SPEECH OF SPARTACUS TO THE GLADIATORS.

4. “Ye call me chief; and ye do well to call *him* chief who, for twelve long years, has met upon the arēna every shape of man or beast the broad empire of Rome could furnish, and who never yet lowered his arm. If there be one among you who can say that ever, in public fight or private brawl, my actions did belie my tongue, let him stand forth and say it. If there be three in all your company dare face me on the bloody sands, let them come on. And yet I was not always thus—a hired butcher, a savage chief of still more savage men! My ancestors came from old Sparta, and settled among the vine-clad rocks and citron groves of Syrasella. My early life ran quiet as the brooks by which I sported; and when, at noon, I gathered the sheep beneath the shade, and played upon the shepherd’s flute, there was a friend, the son of a neighbor, to join me in the pastime.

5. “We led our flocks to the same pasture, and partook together our rustic meal. One evening, after the sheep were folded, and we were all seated beneath the myrtle which shaded our cottage, my grandsire, an old man, was telling of Marāthon and Leuctra; and how, in ancient times, a little band of Spartans, in a defile of the mountains, had withstood a whole army. I did not then know what war was; but my cheeks burned, I knew not why, and I clasped the knees of that venerable man, until my mother, parting the hair from off my forehead, kissed my throbbing temples, and bade me go to rest, and think no more of those old tales and savage wars. That very night the Romans landed on our coast. I saw the breast that had nourished me trampled by the hoof of the war-horse; the bleeding body of my father flung amid the blazing rafters of our dwelling!

6. “To-day I killed a man in the arēna; and when I broke his helmet-clasps, behold, he was my friend. He knew me, smiled faintly, gasped, and died; the same sweet smile upon his lips that I had marked when, in adventurous boyhood, we scaled the lofty cliff to pluck the first ripe grapes, and bear them home in childish triumph. I told the prætor that the dead man had been my friend, generous and brave, and I begged that I might bear away the body, to burn it on a funeral

pile, and mourn over its ashes. Ay, upon my knees, amid the dust and blood of the arēna, I begged that poor boon, while all the assembled maids and matrons, and the holy virgins they call Vestals, and the rabble, shouted in derision, deeming it rare sport, forsooth, to see Rome's fiercest gladiator turn pale and tremble at sight of that piece of bleeding clay! And the prætor drew back as I were pollution, and sternly said, "Let the carrion rot; there are no noble men but Romans!" And so, fellow-gladiators, must you, and so must I, die like dogs. Oh Rome! Rome! thou hast been a tender nurse to me. Ay, thou hast given to that poor, gentle, timid shepherd-lad, who never knew a harsher tone than a flute-note, muscles of iron and a heart of flint; taught him to drive the sword through plaited mail and links of rugged brass, and warm it in the marrow of his foe; to gaze into the glaring eyeballs of the fierce Numidian lion, even as a boy upon a laughing girl. And he shall pay thee back, until the yellow Tiber is red as frothing wine, and in its deepest ooze thy life-blood lies curdled!

7. "Ye stand here now like giants, as ye are. The strength of brass is in your toughened sinews; but to-morrow some Roman Adōnis, breathing sweet perfume from his curly locks, shall with his lily fingers pat your red brawn, and bet his ses'terces upon your blood. Hark! hear ye yon lion roaring in his den? 'Tis three days since he tasted flesh; but to-morrow he shall break his fast upon yours, and a dainty meal for him ye will be. If ye are *beasts*, then stand here like fat oxen, waiting for the butcher's knife! If ye are *men*, follow me! Strike down yon guard, gain the mountain passes, and there do bloody work, as did your sires at old Thermopylæ! Is Sparta dead? Is the old Grecian spirit frozen in your veins, that you do crouch and cower like a belabored hound beneath his master's lash? Oh, comrades! warriors! Thracians! if we must fight, let us fight for *ourselves*! If we must slaughter, let us slaughter our *oppressors*! If we must die, let it be under the clear sky, by the bright waters, in noble, honorable battle.'"—E. KELLOGG.

LESSON XXIII.—THE CONSPIRACY OF CATILINE.

SCARCELY had the revolt of Spartacus been quelled, when the Roman republic was brought to the brink of destruction by a conspiracy headed by the infamous Catiline, a monster

of wickedness, who had acted a distinguished part in the bloody scenes of Scylla's tyranny. At this time Cæsar and Crassus, who, next to Pompey, were the most distinguished of the Roman generals, were so engaged, in their aspirations for power, in courting the favor of the people, that they not only spared Catiline, but perhaps secretly encouraged him, while the only two eminent Romans who boldly determined to uphold their falling country were Cato the younger and the orator Cicero. Even in the very senate-house Catiline boldly confronted Cicero, who there pronounced against him that famous oration which caused the banishment of the traitor and saved the city. We give the following picture of the scene which is supposed to have transpired in the senate on this occasion.

Cicero. Our long dispute must close. Take one proof more
Of this rebellion. Lucius Catiline
Has been commanded to attend the senate.
He dares not come. I now demand your votes.
Is he condemned to exile?

[Enter Catiline hastily. As he seats himself on one side, all the senators go over to the other.]

Cic. (*Turning to Catiline.*) Here I repeat the charge, to gods and men,
Of treasons manifold—that, but this day,
He has received dispatches from the rebels;
That he has leagued with deputies from Gaul
To seize the province; nay, he has levied troops,
And raised his rebel standard; that, but now,
A meeting of conspirators was held
Under his roof, with mystic rites and oaths,
Pledged round the body of a murdered slave.
To these he has no answer.

Catiline. Conscript fathers,
I do not rise to waste the night in words:
Let that plebeian talk; 'tis not my trade;
But here I stand for *right*!—Let him show proofs!—
For *Roman* right; though none, it seems, dare stand
To take their share with me. Ay, cluster there!
Cling to your master, judges, Romans, slaves!
His charge is *false*. I *dare* him to his proofs.
You have my answer: let my actions speak.

Cic. (*Interrupting.*) Deeds shall convince you. Has the traitor done?

Cat. But this I will avow, that I have scorned,
And still do scorn, to hide my sense of wrong.
Who brands me on the forehead, breaks my sword,
Or lays the bloody scourge upon my back,
Wrongs me not half so much as *he* who shuts
The gates of honor on me, turning out
The Roman from his birthright, and for what?
To fling your offices to every slave;
Vipers, that creep where man disdains to climb;

[Looking around.]

And, having wound their loathsome track to the top
Of this huge, mouldering monument of Rome,
Hang hissing at the nobler men below.

Cic. This is his answer. Must I bring more proofs?
Fathers, you know there lives not one of us,
But lives in peril of his midnight sword.
Lists of proscription have been handed round,
In which your properties are made
Your murderer's hire.

[*A cry without, "More prisoners!" Enter an officer with letters for Cicero, who, after looking at them, sends them round the senate.*]

Cic. Fathers of Rome, if men can be convinced
By proof as clear as daylight, here it is.
Look on these letters. Here's a deep-laid plot
To wreck the provinces; a solemn league,
Made with all form and circumstance. The time
Is desperate—all the slaves are up—Rome shakes!
The heavens alone can tell how near our graves
We stand even here! The name of Catiline
Is foremost in the league. He was their king.
Tried and convicted traitor, go from Rome!

Cat. (*Rising haughtily.*) Come, consecrated lictors, from your thrones.
[*To the senators.*]

Fling down your sceptres; take the rod and axe,
And make the murder, as you make the law.

Cic. (*To an officer.*) Give up the record of his banishment.

[*The officer gives it to the consul.*]

Cat. (*With indignation.*) Banished from Rome? What's banished, but
set free

From daily contact of the things I loathe?
"Tried and convicted traitor!" Who says this?
Who'll prove it, at his peril, on my head?
Banished? I thank you for 't. It breaks my chain.
I held some slack allegiance till this hour,
But now my sword's my own. Smile on, my lords.
I scorn to count what feelings, withered hopes,
Strong provocations, bitter, burning wrongs,
I have within my heart's hot cells shut up,
To leave you in your lazy dignities.
But here I stand and scoff you: here I fling
Hatred and full defiance in your face.
Your consul's merciful. For this, all thanks.
He dares not touch a hair of Catiline.

Consul. (*Reads.*) "Lucius Sergius Catiline, by the decree of the senate,
you are declared an enemy and alien to the state, and banished from the
territory of the commonwealth."

[*Turning to the lictors.*]

Lictors, drive the traitor from the temple.

Cat. "Traitor!" I go—but I return. This trial!

Here I devote your senate. I've had wrongs
To stir a fever in the blood of age,
And make the infant's sinews strong as steel.
This day's the birth of sorrows. This hour's work
Will breed proscriptions. Look to your hearths, my lords!
For there henceforth shall sit, for household gods,

Shapes hot from Tartarus! all shames and crimes—
 Wan Treachery, with his thirsty dagger drawn;
 Suspicion, poisoning his brother's cup;
 Naked Rebellion, with the torch and axe,
 Making his wild sport of your blazing thrones;
 Till Anarchy comes down on you like night,
 And Massacre seals Rome's eternal grave.—CROLY.

LESSON XXIV.—WARS OF CÆSAR AND POMPEY—DEATH OF CATO.

1. SOON after the conspiracy of Catiline, which was quelled after a brief struggle by the energy of Cicero, civil war broke out between the adherents of Cæsar and Pompey, and the vast Roman world was divided into two hostile camps. In a great battle, which was fought on the plains of Pharsalia, in Thessaly, Cæsar was victorious, and Pompey, fleeing to Egypt, was slain by order of the Egyptian king Ptolemy, who hoped thereby to secure the favor of Cæsar.

2. After the fall of Pompey, Cæsar passed into Africa, where was a large party still opposed to him, headed by Cato, the sons of Pompey, and other generals. These he defeated in battle; after which Cato, having advised his followers not to continue their resistance, committed suicide. He had seen, he said, the republic passing away, and he could live no longer. After having read Plato on the Immortality of the Soul twice over, as if to prepare his mind for the deed which he meditated, he is supposed to have indulged in the following soliloquy:

CATO'S SOLILOQUY.

[This should be read or spoken deliberately, and the countenance and voice should indicate that the mind is employed in solemn contemplation.]

3. It must be so. Plato', thou reasonest well!
 Else whence this pleasing hope', this fond desire',
 This longing after immortality'?
 Or whence this secret dread and inward horror
 Of falling into naught'? Why shrinks the soul
 Back on herself, and startles at destruction'?
 'Tis the divinity that stirs within us:
 'Tis heaven itself that points out an hereafter,
 And intimates eternity to man.
4. Eternity'! thou pleasing, dreadful thought'!
 Through what variety of untried being,
 Through what new scenes and changes must we pass'?
 The wide, the unbounded prospect lies before me:
 Here will I hold. If there's a Power above us

(And that there is, all nature cries aloud
Through all her works), he must delight in virtue;
And that which he delights in must be happy.
But when' ? or where' ? This world was made for Cæsar.
I'm weary of conjectures—this must end them.

[Laying his hand on his sword.]

5. Thus I am doubly arm'd. My death and life,
My bane and antidote, are both before me.
This, in a moment, brings me to my end;
But this informs me I shall never die.
The soul, secured in her existence, smiles
At the drawn dagger, and defies its point.
The stars shall fade away, the sun himself
Grow dim with age, and nature sink in years;
But thou shalt flourish in immortal youth,
Unhurt amid the war of elements,
The wreck of matter, and the crush of worlds.—ADDISON.
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LESSON XXV.—THE DEATH OF CÆSAR.

1. AFTER Cæsar had finished the war in Africa, the Roman senate created him dictator for ten years; he was appointed censor of the public morals, and his statue was placed opposite that of Jupiter in the Capitol, and on it was inscribed "To Cæsar, the demigod." Not long afterward he was made dictator for life, with the title of imperator, and all the powers of sovereignty were conferred upon him, although the outward form of the republic was allowed to remain.

2. The people, however, soon became suspicious that he courted the title of king; and a large number of senators, headed by the prætors Cassius and Brutus, formed a conspiracy to take his life, and fixed on the day of the meeting of the senate for the execution of their plot. As soon as Cæsar had taken his seat in the senate-house, the conspirators crowded around him, and as one of them, pretending to urge some request, laid hold of his robe as if in the act of supplication, the others, Brutus among the number, rushed upon him with drawn daggers, and he fell, pierced with twenty-three wounds, at the base of Pompey's statue, which was sprinkled with his blood. The scenes which followed—the speech of Brutus in defense of the deed, and the artful funeral oration of Antony, by which the fickle populace were roused to demand vengeance upon the conspirators, are well set forth in the following extract from Shakspeare:

Scene: the Roman forum.

Enter Brutus and Cassius, and a throng of citizens.

Cit. We will be satisfied; let us be satisfied.

Bru. Then follow me, and give me audience, friends.

Cassius, go you into the other street,

And part the numbers.

Those that will hear *me* speak', let them stay here';

Those that will follow *Cassius*', go with him';

And public reasons shall be rendered

Of Cæsar's death.

1st Cit. I will hear *Brutus* speak.

2d Cit. I will hear *Cassius*; and compare their reasons

When severally we hear them rendered.

[Exit Cassius, with some of the citizens. Brutus goes into the rostrum.]

3d Cit. The noble Brutus is ascended: Silence!

Bru. Be patient till the last.

Romans', countrymen,' and lovers'! hear me for my cause; and be silent, that you may hear: believe *me* for mine honor; and have respect to mine honor, that you may believe: censure me in your wisdom; and awake your senses, that you may the better judge. If there be any in this assembly', any dear friend of Cæsar's', to him I say that Brutus's love to Cæsar was no less than his. If then that friend demand why Brutus rose against Cæsar', this is my answer—Not that I loved Cæsar less', but that I loved Rome more'. Had you rather Cæsar were living, and die all slaves', than that Cæsar were dead, to live all freemen'? As Cæsar loved me', I weep' for him; as he was fortunate', I rejoice' at it; as he was valiant', I honor' him; but, as he was ambitious, I slew' him. There are tears' for his love', joy' for his fortune', honor' for his valor', and death' for his ambition. Who is here so base that would be a bondman'? If any, speak; for him have I offended. Who is here so rude that would not be a Roman? If any, speak; for him have I offended. Who is here so vile that will not love his country? If any, speak; for him have I offended. I pause for a reply.

Cit. None', Brutus', none'.

[Several speaking at once.]

Bru. Then none have I offended. I have done no more to Cæsar than you should do to Brutus. The question of his death is enrolled in the Capitol; his glory not extenuated, wherein he was worthy; nor his offenses enforced, for which he suffered death.

Enter Antony and others, with Cæsar's body.

Here comes his body, mourned by Mark Antony; who, though he had no hand in his death, shall receive the benefit of his dying, a place in the commonwealth; as which of you shall not? With this I depart—that, as I slew my best lover for the good of Rome, I have the same dagger for myself, when it shall please my country to need my death.

Cit. Live, Brutus, live! live!

1st Cit. Bring him with triumph home to his house.

2d Cit. Give him a statue with his ancestors.

3d Cit. Let him be Cæsar.

4th Cit. Cæsar's better parts

Shall now be crowned in Brutus.

1st Cit. We'll bring him to his house with shouts and clamors.

Bru. My countrymen—

2d *Cit.* Peace! silence! Brutus speaks.

1st *Cit.* Peace, ho!

Bru. Good countrymen, let me depart alone,
And, for my sake, stay here with Antony:
Do grace to Cæsar's corpse, and grace his speech
Tending to Cæsar's glories, which Mark Antony,
By our permission, is allowed to make.
I do entreat you, not a man depart,
Save I alone, till Antony have spoke.

[*Exit.*

1st *Cit.* Stay, ho! and let us hear Mark Antony.

3d *Cit.* Let him go up into the public chair;
We'll hear him. Noble Antony, go up.

Ant. For Brutus' sake, I am beholden to you.

4th *Cit.* What does he say of Brutus?

3d *Cit.* He says, for Brutus' sake,
He finds himself beholden to us all.

4th *Cit.* 'Twere best he speak no harm of Brutus here.

1st *Cit.* This Cæsar was a tyrant.

3d *Cit.* Nay, that's certain:
We are blessed that Rome is rid of him.

2d *Cit.* Peace; let us hear what Antony can say.

Ant. You gentle Romans—

Cit. Peace, ho! let us hear him.

Ant. Friends', Romans', countrymen', lend me your ears;
I come to *bury*¹ Cæsar, not to *praise* him'.

The *evil* that men do lives after them;
The *good* is oft interred with their bones:
So let it be with Cæsar. The noble Brutus

Hath told you Cæsar was ambitious:

If it were so, it were a grievous fault,

And grievously hath Cæsar answered it.

Here, under leave of Brutus, and the rest

(For Brutus is an honorable man';*

So are they all', all honorable men'),

Come I to speak in Cæsar's funeral.

He was my friend', faithful and just' to me;

But Brutus' says' he was ambitious';

And Brutus is an honorable man'.

He hath brought many captives home to Rome,

Whose ransoms did the general coffers fill:

Did this in Cæsar seem ambitious'?

When that the poor have cried', Cæsar hath wept':

Ambition should be made of sterner stuff;

Yet Brutus says' he was ambitious';

And Brutus is an honorable man'.

You did all see that on the Lupercal

I thrice presented him a kingly crown,

Which he did thrice refuse. Was this ambition?

Yet Brutus says' he was ambitious';

And sure he is an honorable man'.

* The falling inflection is frequently given to "honorable," and the rising to "man;" but Antony would hardly have ventured upon irony so open, while his auditors were so little prepared for it. The rising circumflex should be distinctly given to the word "*honorable*."

I speak not to disprove what Brutus spoke,
 But here I am to speak what I do know.
 You all did love him once ; not without cause ;
 What cause withholds you, then, to mourn' for him ?
 Oh judgment, thou art fled to brutish beasts,
 And men have lost their reason ! Bear with me ;
 My heart is in the coffin there with Cæsar,
 And I must pause till it come back to me.

1st Cit. Methinks there is much reason in his sayings.

2d Cit. If thou consider rightly of the matter,
 Cæsar has had great wrong.

3d Cit. Has he, masters ?

I fear there will a worse come in his place.

4th Cit. Marked ye his words ? He would not take the crown ; therefore 'tis certain he was *not* ambitious.

1st Cit. If it be found so, some will dear abide it.

2d Cit. Poor soul ! his eyes are red as fire with weeping.

3d Cit. There's not a nobler man in Rome than Antony.

4th Cit. Now mark him ; he begins again to speak.

Ant. But yesterday, the word of Cæsar might
 Have stood against the world' : now lies he there,
 And none so poor to do him reverence.

Oh masters' ! if I were disposed to stir
 Your hearts and minds to mutiny and rage,
 I should do Brutus' wrong, and Cassius' wrong,
 Who, you all know, are honorable men'.
 I will not do them wrong ; I rather choose
 To wrong the dead', to wrong myself, and you,
 Than I will wrong such honorable men'.

But here's a parchment with the seal of Cæsar ;
 I found it in his closet ; 'tis his will :
 Let but the commons hear this testament
 (Which, pardon me, I do not mean to read),
 And they would go and kiss dead Cæsar's wounds,
 And dip their napkins in his sacred blood ;
 Yea, beg a hair of him for memory,
 And, dying, mention it within their wills,
 Bequeathing it as a rich legacy
 Unto their issue.

4th Cit. We'll hear the will. Read it, Mark Antony.

Cit. The will, the will ; we will hear Cæsar's will.

Ant. Have patience, gentle friends ; I must not read it ;
 It is not meet you know how Cæsar loved you.
 You are not wood, you are not stones, but men ;
 And, being men, hearing the will of Cæsar,
 It will inflame you, it will make you mad :
 'Tis good you know not that you are his heirs ;
 For, if you should, oh, what would come of it !

4th Cit. Read the will ; we *will* hear it, Antony ;
 You *shall* read us the will—Cæsar's will.

Ant. Will you be patient ? Will you stay a while ?
 I have o'ershot myself to tell you of it.
 I fear I wrong the honorable men
 Whose daggers have stabbed Cæsar : I do fear it.

4th *Cit.* They were traitors! Honorable men!

Cit. The will! the testament!

2d *Cit.* They were villains, murderers. The will—read the will!

Ant. You will compel me, then, to read the will?

Then make a ring about the corpse of Cæsar,

And let me show you him that made the will.

Shall I descend? And will you give me leave?

Cit. Come down.

2d *Cit.* Descend.

[*He comes down from the pulpit.*]

3d *Cit.* You shall have leave.

4th *Cit.* A ring; stand round.

1st *Cit.* Stand from the hearse, stand from the body.

2d *Cit.* Room for Antony—most noble Antony.

Ant. Nay, press not so upon me; stand far off.

Cit. Stand back! room! bear back!

Ant. If you have tears, prepare to shed them now.

You all do know this mantle: I remember

The first time ever Cæsar put it on;

'Twas on a summer's evening, in his tent—

That day he overcame the Nervii.

Look! in this place ran Cassius' dagger through;

See what a rent the envious Casca made;

Through this, the well-beloved Brutus stabbed;

And, as he plucked his cursed steel away,

Mark how the blood of Cæsar followed it,

As rushing out of doors, to be resolved

If Brutus so unkindly knocked or no;

For Brutus, as you know, was Cæsar's angel:

Judge, oh you gods, how dearly Cæsar loved him!

This was the most unkindest cut of all;

For, when the noble Cæsar saw him stab,

Ingratitude, more strong than traitors' arms,

Quite vanquished him. Then burst his mighty heart;

And, in his mantle muffling up his face,

Even at the base of Pompey's statue,

Which all the while ran blood, great Cæsar fell.

Oh, what a fall was there, my countrymen!

Then I, and you, and all of us fell down,

While bloody treason flourished over us.

Oh, now you weep; and, I perceive, you feel

The dint of pity: these are gracious drops.

Kind souls, what, weep you, when you but behold

Our Cæsar's vesture wounded? Look you here;

Here is himself, marred, as you see, with traitors.

1st *Cit.* Oh piteous spectacle!

2d *Cit.* Oh noble Cæsar!

3d *Cit.* Oh woeful day!

4th *Cit.* Oh traitors, villains!

1st *Cit.* Oh most bloody sight!

2d *Cit.* We will be revenged: revenge; about—seek—burn, fire—kill—slay! let not a traitor live.

Ant. Stay, countrymen.

1st *Cit.* Peace, there! hear the noble Antony.

2d *Cit.* We'll hear him, we'll follow him, we'll die with him.

Ant. Good friends, sweet friends, let me not stir you up
 To such a sudden flood of mutiny.
 They that have done this deed are honorable:
 What private griefs they have, alas! I know not,
 That made them do 't; they are wise and honorable,
 And will, no doubt, with reasons answer you.
 I come not, friends, to steal away your hearts;
 I am no orator, as Brutus is;
 But, as you know me all, a plain, blunt man,
 That love my friend, and that they know full well
 That gave me public leave to speak of him;
 For I have neither wit, nor words, nor worth,
 Action, nor utterance, nor the power of speech,
 To stir men's blood: I only speak right on;
 I tell you that which you yourselves do know;
 Show you sweet Cæsar's wounds, poor, poor dumb mouths,
 And bid them speak for me; but, were I Brutus,
 And Brutus Antony, there were an Antony
 Would ruffle up your spirits, and put a tongue
 In every wound of Cæsar, that should move
 The stones of Rome to rise and mutiny.

LESSON XXVI.—END OF THE ROMAN REPUBLIC.

1. THE effect of Antony's artful oration was such as to fill the multitude with indignation and rage; and while some, tearing up the benches of the senate-house, formed of them a funeral pile and burned the body of Cæsar, others ran through the streets with drawn weapons and flaming torches, denouncing vengeance against the conspirators. Brutus and Cassius, and their adherents, fleeing to Greece, and thus securing the eastern provinces, prepared to defend themselves by force of arms. Antony, remaining at Rome, and aided by Lep'idus, sought to place himself at the head of the state; but he found a powerful rival in the young Octavius Cæsar, and civil war for a time raged in Italy.

2. At length Antony and Octavius, having agreed to settle their differences, marched with united forces against the conspirators, whose army they defeated in the battle of Philippi, a small town in Thrace. Both Cassius and Brutus, giving way to despair, destroyed themselves. Over the dead body, Antony did justice to the character of Brutus, whom he declared to be "the noblest Roman of them all."

"This was the noblest Roman of them all:
 All the conspirators, save only he,
 Did that they did in envy of great Cæsar;
 He only, in a general honest thought,

And common good to all, made one of them.
His life was gentle, and the elements
So mix'd in him, that Nature might stand up,
And say to all the world, *This was a man!*"

3. After the battle of Philippi, Octavius returned to Italy at the head of his legions, and Antony remained master of the eastern provinces. While Antony was in Asia Minor the celebrated Cleopatra came to visit him, and so captivated was the Roman with the charms and beauty of the Egyptian queen, that he accompanied her to Egypt, where he lived for a time in indolence, dissipation, and luxury, neglectful of the calls of interest, honor, and ambition. But his shameful conduct soon brought on a war between him and Octavius, and, being defeated in the naval battle of Actium, he fled again to Egypt, and there put an end to his own life.

4. Soon after the death of Antony, Octavius, at the request of the most eminent citizens, who were glad to seek refuge from anarchy and civil war in a military despotism, took the government into his own hands, and with this event, at the beginning of the 28th year before the Christian era, the history of the *Roman republic* ends. The senate then conferred upon Octavius the title of AUGUSTUS, or "the Divine." After a brief period of wars in some of the distant provinces, peace was established throughout the vast domains of the empire. It was at this auspicious period that Jesus Christ, the promised Messiah, was born, and thus literally was his advent the herald of "peace on earth and good-will toward men."

HISTORIC ASSOCIATIONS.

WHATEVER withdraws us from the power of our senses, whatever makes the past, the distant, or the future predominate over the present, advances us in the dignity of thinking beings. Far from me and far from my friends be such frigid philosophy as may conduct us, indifferent and unmoved, over any ground which has been dignified by wisdom, bravery, or virtue. That man is little to be envied whose patriotism would not gain force upon the plains of Marathon, or whose piety would not grow warmer among the ruins of Iona.—
DR. JOHNSON.

K E Y

TO THE SOUNDS OF THE LETTERS, AS DESIGNATED IN THE SCHOOL AND FAMILY READERS.

The system of pronunciation here adopted is that of Noah Webster, as contained in the later and improved editions of his Dictionary; and the indicative marks used are *the same* as those found in Webster's late "Pronouncing and Defining Dictionary," edited by Prof. Goodrich.

- Ā*, long, as in fame, aim, dāy, breāk, cāke, māke; heard also in sail, veil, gauge, inveigh.
Ā, short, as in fāt, āt, cārry, tārriff; heard also in plāid, bāde, rāillery, etc.
Ā, *Italian*, as in fār, fāther, bālm, pāth; heard also in heārt, heārth, āunt, hāunch.
Ā, as in cāre, āir, shāre, pāir, beār, fāir, pārent; heard also in where, heir.
Ā, as in lāst, āsk, grāss, dānce, brānch, stāff, grāft, pāss, chānce, chānt.
Ā, sound of broad *a*, as in all, call, talk, hāul, swarm, awe; heard also in naught, taught.
Ā, short sound of broad *a*, as in whāt, wash. This coincides with the *o* in *not*.
Ē, long, as in mē, mēte, schēme; heard also in bēard, fēld, lēisure, briēf, sēize, kēy.
Ē, short, as in mēt, mērry; heard also in fēather, hēifer, lēopard, any, friēnd, guēss.
Ē, like *ā* in cāre; as in thēre, thēir, hēir, whēre, ēre, ē'er, whenē'er, etc.
Ē, short *e* before *r*, as in tērm, vērge, vērdure, prēfer, ēarth.
Ē, like long *ā*, as in prēy, thēy, survey.
Ī, like long *ē*, as in pique, machine, mien, marine. This is the sound of the French *i*.
Ī, long, as in pine, fine, isle; heard also in height, aisle, oblige, microscope.
Ī, short, as in pin, fin, pit; heard also in sieve, since, been (bin), etc.
Ī, short, verging toward *u*, as in bird, firm, virgin, dirt.
Ō, long, as in nōte, ōh, nō, dōme; heard also in cōurse, yeōman, rōll, pōrt, dōor, etc.
Ō, short, as in nōt, bōnd; heard also in cōral, Cōrinth. It coincides with the *a* in *what*.
Ō, like short *u*, as in dōve, lōve, sōn, dōne, wōrm; heard also in dōes (duz), nōne (nun).
Ō, like long *oo*, as in prōve, dō, mōve, tōmb, lōse, whō, tō.
Ō, like short *oo*, as in wōlf, Wōlsey. This sound coincides with that of *u* in bull.
ŌŌ (short *oo*), as in fōot, bōok, wōol, wōod.
Ū, long, as in mūte, dūty, cūbe, ūnite, has the sound of *yū*, slightly approaching *yoo* when it begins a syllable; but in other cases it is difficult to distinguish the sound of the *y*.
Ū, short, as in bīt, tūb, sūn; heard also in dōes (duz), blood (blud), etc.
Ū, long, nearly approaching *oo* when preceded by *r*, as rāle, rāde, rāby.
Ū, like *oo* (short *oo*), as in full, bull, pull, push, put (not pūt).
E (*italic*) marks a letter as silent, as fallen, token.

CONSONANTS.

- C c* soft (unmarked), like *s* sharp, as in cede, mercy.
C c hard, like *k*, as in call, carry.
CH ch (unmarked), like *tsh*, as in child, choose.
Ĉ ĉ soft, like *sh*, as in machine, chaise.
Ĉ ĉ hard, like *k*, as in chorus, epoch.
G g hard (unmarked), as in go, gallant.
Ĝ ĝ soft, like *j*, as in gentle, aged.
S s sharp (unmarked), as in same, gas.
Ŝ ŝ soft, like *z*, as in has, amuse.
TH th sharp (unmarked), as in thing, path.
TH th flat or vocal, as in thine, their.
N^o like *ng*, as in lon^gger, con^gress.
PH ph like *f* (unmarked), as in phaeton, sylph.
QU qu like *kw* (unmarked), as in queen, inquiry.
WH wh like *hw* (unmarked), as in when, while.

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